AMERICAN
DYESTUFF REPORTER

Volume 47 November 3, 1958 Number 22

RECENT HISTORY IN TEXTILE PRINTING

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In its issue of August 29, 1958, *The Dyer*, in its "Notes and Opinions" column calls the closing of the roller printing plant at Broad Oak Works "one of the saddest results to date of the severity of conditions in the cotton industry".

The British publication then goes on to state that "the story of the redundant plant in calico printing goes back for many years", and proceeds to editorialize on the problems faced by the Calico Printers' Association and the continued loss of business in traditional markets.

The British situation has indeed had its parallel in this country, and in this article the author delves into the recent history of silk printing and cotton printing in an attempt to point up some of the reasons for the situation as it exists today.

SILK PRINTING

IT is not surprising to find that there were only sixteen printing machines operating in 1903, which is 55 years ago, as compared with 87 machines in place today.

Silk has been off the market for many years, partly due to the war, but in this writer's opinion, probably more due to the fact that the dyers and printers of the days immediately before the last World War grossly over-weighted nearly all silks so that there was more tin than silk in the finished goods.

The women of the country no longer looked upon silk as the premier fiber. It looked poor, it had lost its lofty, silky hand and it was inferior in wearing qualities.

Soon after World War I, with the advent of what was then called artificial silk, now known as rayon, silk had a near-competitor and with the subsequent improvement that occurred in viscose rayon, and the concurrent deterioration in the appearance and wearing properties of silk, due to over-weighting, silk was on the way out before the second World War broke out and put a stop to importation of Japanese and Chinese raw silk.

However, the increase in the manufacture of rayon and later of acetate fiber in this country resulted in a demand for more yardage of printed fabrics woven of these two fibers than we had ever had of all-silk goods.

Rapidly the number of printing machines rose to about 100 machines, which was probably too many for the yardage potential of the industry.

Then some bright entrepreneur, and we use this word advisedly, to distinguish him from what we might call the legitimate printer, who had served an apprenticeship to the business and who was probably an actual colorist by profession, this brilliant person, whom we might call a "muscler-in," conceived the idea of running his few machines day and night, and sometimes all day Saturday and Sunday too.

He reasoned that he was saving on taxes, rent, interest on borrowed money and many other items of overhead too numerous to mention. Also that he had miraculously increased his plant from a three- or four-machine outfit to a nine- or 12-machine shop.

What he didn't remember was that daylight work is always better on a print-machine, and that the three shifts he was running required three times the number of supervisors that he had been employing on the one-shift plan. Likewise, he did not realize that everybody likes to work under what are ideal conditions, ie, on the day shift; that it was going to be hard to get (and keep) foremen on the other two shifts; that, as soon as they could, they would leave to take a day job. And especially on the third shift would he have trouble; frequently he had to put up with a certain number of people of the type who liked to work on the third shift, planning to sleep a good part of the shift, with a bit of luck.

Another thing he didn't reckon with was that two (or more) could play at that game, *and sure enough they did*. So that, overnight as it were, up went the total of machines in the silk and rayon printing business from 100 to 300 machines. Well, not quite that. There were a few who didn't think it was such a good idea. These were they who were still there when the smoke cleared away. Nevertheless, an unhappy time was had by all.

The result was that even in times when there would have been plenty of work for the 100 machines on a one-shift basis, there was a lot of price-cutting going on, which was disastrous for all. It just meant that it was hard to show a profit even in the so-called good times.

Now, to get down to more modern history.

Just five years ago, in 1953, there were 17 concerns engaged in the silk and man-made fiber fabric printing industry. They were running 107 machines.

Since then, seven companies owning 42 machines have gone out of business as far as printing is concerned; two other concerns have reduced the total of machines they were running in 1953 from 18 to 11. This makes a reduction of 49 machines, thus practically cutting the number of active machines in two. "Happy times are here again?"—By no means.

In the meantime, in came 11 more venturesome spirits with a total of 35 printing machines. But lo! when 1958 rolled around 12 of these machines were once more put on the retired list.

The upshot of all this seems to be, according to our calculations, and we do not point with pride to our ability as a calculator, that there are now 19 people in this distressful business having a total of 87 print machines. Still too many?

COTTON PRINTING

Five years ago, to be exact in September 1953, there were, in the entire United States, 344 textile printing machines engaged principally in printing cotton goods.

These were situated in 40 individual

printworks buildings. 176 of them, constituting the majority, were located in the New England States, 30 of them were in the Middle Atlantic States and 137 were in the southeastern section of the country. One lone machine was to be found under the designation of "Other States."

The 40 printing establishments were owned by 35 concerns. The average ownership of printing machines was slightly under 10 machines per concern.

If, however, we deduct from this list the ten proprietors who owned more than 10 printing machines apiece, we have left 25 establishments totalling 130 printing machines, the average ownership being 5.2 machines per firm, as against an average of 21.14 for the 10 larger concerns.

And now let us see what has happened to this remarkable industry in the short space of five eventful years.

Of the old concerns existent in 1953, some of them very old established concerns, 10 of them, having a total of 84 machines, liquidated voluntarily, most, if not all of them, during 1957 and 1958. These particular people decided that the printing business was "kaput" or that their competition was either cleverer than they were, or *non compos mentis*, and that they wanted no more of it.

During that same period some of the people that were running printworks in New England felt that it was the part of wisdom to reduce their operations. It is significant that the reduction in operations took the form of closing and liquidating the Northern plants and retaining the Southern ones, in most cases.

"Naught may endure but mutability," said Shelley, so it is by no means startling to find that whereas some of the older members of the craft had moved South and the others had decided to leave the distressful business altogether, others had made up their minds that the textile printing business was for them, and strange to say, that bucking the tide was what they excelled in, consequently, they mostly started up these businesses in New England.

TABLE I
Change in *number* and *ownership* of textile printing machines

Year	*1953*	*1958*
Number of plants	40	35
Number of machines	344	302
Number of owners	35	27
Average ownership	9.8 machines apiece	11.18 machines apiece

TABLE II
Change in location of textile printing machines during the five-year period

Year	*1953*	*1958*
New England	176	101
Middle Atlantic	30	26
Southeast	137	175
Other States	1	—

And so, we find that these adventurous souls inaugurated 11 new plants having 25 machines or an average of a little better than four machines apiece.

Although the total number of machines working principally on cotton goods appears to have dropped in five years from 344 to 302, which is a favorable circumstance, regarding the industry as a whole, it is quite certain that if all these printing machines ran at the speed and for the hours that their respective owners would like them to run, we would still have an unhealthy state of overproduction.

Let us assume, for instance, that they would run at the rate of 2000 yards per hour, which is not phenomenal; let us further imagine that 300 of them were running a whole year at this rate. We would arrive at the the following figures:

Production per hour	600,000 yards
per day (24 hours)	14,400,000
per week (6 days)	86,400,000
per year (52 weeks)	4,492,800,000

The population of the world is roughly about two billion persons. Thus we see that such a production would supply every man, woman and child with a quota of approximately 2.25 yards of printed cotton, without deduction for nudist colonies, babies in arms, etcetera, especially etcetera.

In this calculation we have considered only U S print production and, moreover, only the production of those printing machines devoted chiefly to the printing of all-cotton goods. We must remember, however, that in foreign countries there are printing machines galore. We would not be a bit surprised if the number of printing machines in Great Britain exceeded the number in our own country. It should not be overlooked that in France, Germany, Czechoslovakia, Austria and Hungary there exist printworks having productive power equal to our own or that of Britain; while in the USSR there is a printworks in Moscow, at one time managed by our old friend John Cecil Watson, a graduate of the big Steiner Works in Church, Lancashire, which boasted of 300 print machines some years ago. It may be even bigger now. Even some of the other countries, who never did any printing except by hand, seem to be "rolling their own." It may surprise you to know that Turkey, for instance, which had five machines back in 1950, is now said to be running 35 printmachines today, according to the *Hoechst News*, a splendidly printed publication sent us recently by one of our friends, probably Albert Schaeffer of that company or Karl Kuhl II of the American branch of the organization.

And so, to roughly paraphrase Gilbert and Sullivan:

"Taking one thing in consideration with another,
A printer's lot is not a happy one."

—Q.E.F.

General Calendar

AMERICAN ASSOCIATION OF TEXTILE TECHNOLOGY
Nov 5, Jan 7, Feb 4, Mar 4, Apr 1 (Della Robbia Room, Hotel Vanderbilt, New York, NY)

AMERICAN COTTON MANUFACTURERS INSTITUTE
Mar 19-21 (Annual Convention — Palm Beach Biltmore Hotel, Palm Beach, Fla)

AMERICAN OIL CHEMISTS SOCIETY
April 20-22, 1959 (Roosevelt Hotel, New Orleans, La; Sept 28-30, 1959 (Statler Hotel, Los Angeles, Calif)

AMERICAN STANDARDS ASSOCIATION
Nov 18-20 (9th National Conference on Standards, Hotel Roosevelt, New York, NY)

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS (QUEBEC SECTION)
Nov 15, Dec 13 (McGill Univ, Montreal, Que); Jan 30 (joint meeting with Textile Society of Canada Eastern Div, Ritz Carlton Hotel, Montreal); Feb 21, Mar 21, Apr 18 (McGill Univ, Montreal, Que); June 20 (Annual Golf Tournament)

DIVISION OF CLOTHING AND TEXTILES IN EXTENSION, TEACHING AND RESEARCH, UNIVERSITY OF GEORGIA
Nov 7-8 (2nd Textile Seminar, Georgia Center for Continuing Education, Athens, Ga)

THE FIBER SOCIETY
April 29-30 (Fontana Village, NC)

MANUFACTURING CHEMISTS' ASSOCIATION
Nov 25 (8th Semi-Annual Meeting and Winter Conference, Hotel Statler, New York, NY)

NEW YORK ACADEMY OF SCIENCES
Nov 14-15 (Conference on Radiation and High-temperature Behavior of Textiles, Barbizon-Plaza Hotel, New York, NY)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Oct 8, Nov 12, Dec 3, Jan 13, Feb 10, March 11 (Luncheon meetings at the Hotel Roosevelt, New York, NY)

Proceedings of the

American Association of Textile Chemists and Colorists

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November 3, 1958

8th ADR AWARD TO VALKO, TESORO, AND GINILEWICZ

EMERY I VALKO

GIULIANA C TESORO

WALDEK L GINILEWICZ

The presentation of the eighth annual AMERICAN DYESTUFF REPORTER AWARD was made October 31, 1958, during the Annual Banquet at the 37th National Convention of the AATCC at the Conrad Hilton Hotel, Chicago, Ill.

The Award, presented by William A Holst of the AATCC Publications Committee, was for the paper, "Elimination of Static Electricity from Textiles by Chemical Finishing," by Emery I Valko, Giuliana C Tesoro, and Waldek L Ginilewicz. The paper was presented by Prof Valko at the 36th National Convention at the Hotel Statler, Boston, Mass, on November 16, 1957. It appeared in the *Proceedings* in the June 16, 1958 issue of *American Dyestuff Reporter*.

Emery I Valko received his Ph D from the University of Vienna. In 1939, after 10 years service at the research department of I G Farben in Germany, he joined Onyx Oil and Chemical Co, Jersey City, NJ. In 1946, he became director of research of E F Drew and Co, and in 1949, an independent research consultant. In 1954, he rejoined Onyx as vice president in charge of research and development. He resigned from Onyx this year to accept an appointment as associate professor in the Division of Chemistry of Lowell Technological Institute.

Dr Valko is author or co-author of more than 50 technical papers and several books, among which is a book published in Germany in 1937 entitled "Colloid-Chemical Principles of Textile Processing." He is the inventor of numerous patents.

Dr Valko served from 1952 to 1956 as a collaborator for the Cotton Fiber Section at the Southern Regional Research Laboratory, U S Dept of Agriculture. He was chairman of the Gordon Research Conference on Textiles in 1958.

Dr Valko is a fellow of the Textile Institute, Manchester, England; the Society of Dyers and Colourists; and the New York Academy of Sciences. He is a member of AATCC, has served on several committees of the Metropolitan Section, and has presented papers before local sections as well as general meetings of the Association.

Giuliana Cavaglieri Tesoro was born in Venice, Italy, June 1, 1921. She married Victor Tesoro in 1943 and is the mother of two children, Claudia, age 8, and Andrew, age 6. She attended high school and junior college in Italy before obtaining her Ph D in organic chemistry from Yale University in February, 1943.

Dr Tesoro served as a research chemist with American Cyanamid Co, 1943-1944, before joining Onyx Oil and Chemical Co. With Onyx from 1944-1958, she served as research chemist, head of organic research, assistant research director, and associate research director. Since March of this year, Dr Tesoro has served as head of organic research, Central Research Laboratory, J P Stevens & Co, Inc, Garfield, NJ.

Dr Tesoro's research activities have been in the following fields: pharmaceuticals, organic intermediates, surface-active agents, quaternary ammonium germicides, textile finishing agents, and chemical modification of fibers.

Dr Tesoro holds membership in AATCC, American Association of Textile Technology, American Chemical Society, New York Academy of Science, and the Society of Sigma Xi.

Waldek Ginilewicz, who is 32 years old, was educated in England, where he received a B Sc in textile chemistry and pursued graduate courses in polymer chemistry and physical chemistry of high polymers. He is an associate of the Textile Institute (England).

Mr Ginilewicz has been employed as a head of the Testing Laboratory at Sir E Armitage Sons Ltd, Salford, England; and laboratory supervisor at J P Stevens & Co, Inc, New York. He is presently a group leader of

(*concluded on page P776*)

37th National Convention———

AFTERMERCERIZATION OF WRINKLE-RESISTANT COTTONS FOR IMPROVED STRENGTH AND ABRASION RESISTANCE*

ROBERT M REINHARDT, RUSSELL M H KULLMAN, HARRY B MOORE, and J DAVID REID

Southern Regional Research Laboratory[1]
New Orleans, La

A previous study showed that improvement in tearing strength and abrasion resistance was produced by aftermercerization of cotton treated with methylolmelamine. This study has been continued with fabric treated with a number of other finishing agents.

Along with the beneficial effects, there is some loss of wrinkle recovery angle. This loss can be kept to a minimum with properly selected conditions for mercerization of the treated fabric. The gain in strength and abrasion resistance appears to outweigh the loss in wrinkle resistance. Well-cured samples can be mercerized to effect the improvements and still have acceptable wrinkle recovery angles.

Wrinkle-resistant cottons investigated were fabrics treated with both nitrogenous and with nonnitrogenous finishing agents. The former group included dimethylol cyclic ethyleneurea, methylated methylolmelamine and methylolated triazone derivatives. Formaldehyde, glutaraldehyde, pentaerythritol acetal, and an epoxy finishing agent were among those of the nonnitrogenous group.

Variables in the conditions of mercerization and the results obtained are discussed. The effect of fabric construction on changes in tearing strength caused by mercerization of cloth treated with dimethylol cyclic ethyleneurea is also considered.

INTRODUCTION

SINCE the introduction of resin treatments of textiles in the early 1930's, these finishing processes have grown steadily in importance, until in 1957, two billion yards of cotton were so treated. Resin finishing brings about a number of improvements in cotton, namely, dimensional stability, wrinkle resistance, improved hand, etc. More recently, a great deal of resin finishing of cotton is for wash-and-wear and minimum-care properties. However, these improved properties are effected at the expense of strength, particularly tearing strength, and abrasion resistance.

A number of additives and techniques have been proposed to decrease the extent of these losses or to regain part of the losses. Lubricants, softeners, and thermoplastic material have been suggested for incorporation in the resin pad bath (*1-4*). Premercerization of the cloth has been recommended for many years (*5-6*). Compressive shrinkage of the fabric following resin treatment also has been advocated (*7*).

Aftermercerization of the resin-treated fabrics also has been suggested as a means of bringing about improvements in these properties (*8, 9*). The purpose of the present paper is to extend this work and show the effect of aftermercerization on cotton treated with a number of wrinkle-resistant finishing agents.

BACKGROUND

Aftermercerization was demonstrated early in the history of resin finishing of cellulosics to be a means of improving strength and abrasion resistance which had been decreased as a result of the resin treatment. With linen, aftermercerization is essential if a resin is applied. For example, aftermercerization with about 12% shrinkage is cited in a British patent (*8*) as increasing the breaking strength of linen treated with urea-formaldehyde from 17.3 lb to over 30 lb. Although it has been stated from time to time in the literature that aftermercerization is in common use on resin-treated cotton in Europe, personal contacts, who are very closely in touch with the finishing industry of Europe, refute this. At times, a few high-quality European finishers have employed the technique, but it is not used as a routine procedure. In this country, aftermercerization has been used occasionally to improve the properties of wrinkle-resistant cottons which are below standards because of some accident in the finishing process.

Although aftermercerization is frequently mentioned in informal discussions of finishing and in question-and-answer sessions (*10-11*), very little has actually been published on the subject. In addition to the above-cited patent on resin-treated linen, only two other papers actually reporting data are known to the present authors. One, published in 1952, briefly reports on aftermercerization in a study of the variables in the resin treatment of cotton (*12*). The other is the previous paper from this Laboratory (*9*).

THEORY OF EFFECTS OF AFTERMERCERIZATION

Previous work (*9*) has shown that aftermercerization of cotton print cloth, treated with methylolmelamine, effected improved tearing strength and abrasion resistance. The magnitudes of the increases were up to 20% in tearing strength and to 100% and sometimes higher in abrasion resistance. Wrinkle resistance was slightly reduced.

Evidence of some mercerization having occurred was indicated by a number of observations made in the study. Microscopic examination of the fibers showed a swollen cross-sectional appearance intermediate between that of typical raw and typical mercerized cotton. Index of refraction, measured parallel to the fiber axis, also pointed to a partial mercerization. X-ray diffractometer tracings which showed swelling and reduction in cellulose I interferences confirmed this qualitatively. Moisture regain data likewise supported the theory of swelling and partial mercerization.

* Presented by Robert M Reinhardt on October 30, 1958, at the Conrad Hilton Hotel, Chicago, Ill, during the 37th National Convention.

[1] One of the laboratories of the Southern Utilization Research and Development Div, Agricultural Research Service, U S Dept of Agriculture.

Additional physical evidence was obtained from Instron[2] measurements of elastic recovery and permanent set. The latter, substantially reduced by resin treatment, was further reduced by aftermercerization.

The strong caustic solution used in the aftertreatment also caused some resin hydrolysis or solubilization, which resulted in partial loss of resin. The resin which is thus removed is most likely that which has been deposited on the surface of the fiber and in microscopic fissures and cracks. Since great losses of wrinkle recovery were not experienced, extensive cleavage of the resin-introduced crosslinks is not likely.

Thus, it appears likely that aftermercerization of wrinkle-resistant cottons acts in two ways: 1) a partial mercerization takes place in the regions which remain accessible after resin treatment; and 2) a small amount of resin, possibly that which is deposited on fiber surfaces, is removed, eliminating an abrasive effect.

The work which is reported here was performed on the basis of the above premises. An attempt was made to determine the effects of aftermercerization on cotton treated for wrinkle resistance with a number of the principal finishing agents in use today. Several finishing agents of potential commercial interest or of theoretical value were also included in the study.

MATERIALS AND METHODS

Most of the experiments were conducted using an 80 x 80 white cotton print cloth (3.2 oz/sq yd) which had been boiled, bleached, and desized. Cotton fabrics of twenty-three different constructions, each varying one parameter of construction, were also used in this investigation. These latter fabrics were made available by Fabric Research Laboratories, Inc.

The resin treatment, in general, was carried out as follows: The fabric was padded to about 75% wet pickup with the finishing agent using two dips and two nips. After impregnation, the resin-wet cotton was mounted on pin-frames and dried and cured in a mechanical convection oven. The treated fabric was then given a process wash with nonionic detergent to remove unreacted resin, unused catalyst, and byproducts. Wet pickup and final add-on were determined by weight of the sample as compared with the original weight.

[2] Throughout this paper, trade names and firms are given merely to present an exact report of materials and instruments used. Mention of trade names and firms does not constitute an endorsement by the Department of Agriculture over others not mentioned.

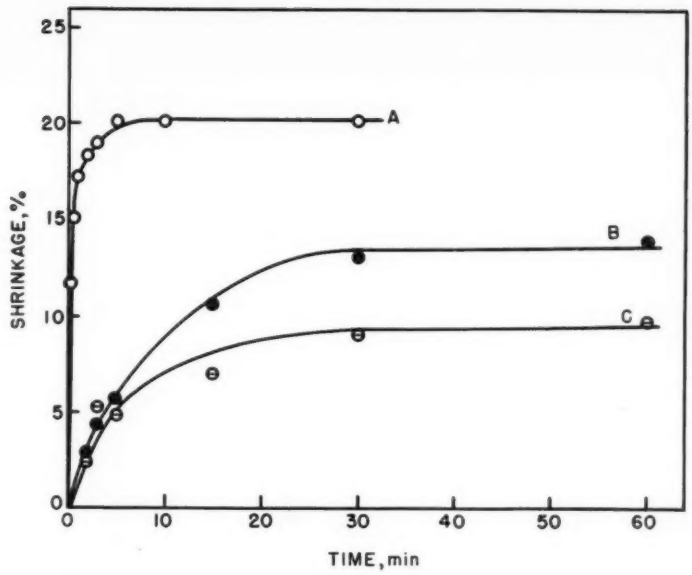

Figure 1
Shrinkage, in area, resulting from treatment with 20% sodium hydroxide solution at room temperature without restraint. A is 80 x 80 cotton print cloth; B, print cloth finished with methylated methylolmelamine; C, print cloth finished with dimethylol cyclic ethyleneurea.

The principal nitrogenous finishing agents used, with their catalysts and conditions of cure, were as follows:

Finishing agent	*Catalyst*	*Time and temp of cure*
Rhonite R-1 (dimethylol cyclic ethyleneurea)	Catalyst H-7 (modified zinc complex)	4 min at 160° C
Acrotex M-3 (methylated methylol-melamine)	Accelerator MX	4 min at 160° C
Methylolated triazone derivative	Not identified	4 min at 160° C
Urea-formaldehyde (dimethylolurea)	Catalyst AC (nonammonium stable organic salt)	4 min at 150° C

Aftermercerization was carried out on Plexiglas pin frames (*9*). In general, samples were held at original dimensions and treated with 20% sodium hydroxide solution containing 0.1% Alkamerse R wetting agent at room temperature (27°C) for 20 minutes. Variations of these conditions were also investigated and are reported. After the alkali treatment, samples were washed and soured with dilute acetic acid and rinsed. Upon removal from the frame they were ironed and air-equilibrated.

Textile testing was performed under standard conditions of 70°F and 65% relative humidity. Tearing strength was determined by the Elmendorf method (*13a*), flex abrasion resistance on the Stoll abrader (*13b*), wrinkle recovery on the Monsanto tester (*13c*), breaking strength by the ravelled-strip method (*13d*), and stiffness by the Tinius-Olsen method (*14*). The Kjeldahl method was used to determine the nitrogen content of fabrics which had been treated with nitrogen-containing resins.

EXPERIMENTAL AND DISCUSSION

VARIABLES OF AFTERMERCERIZATION ——— In the previous paper (*9*), the effect of changes in the variables of aftermercerization was shown with methylolmelamine-treated cotton. The importance of control of the variables, such as time, temperature and concentration of alkali, and of resin add-on of the finished cotton, was borne out in the present investigation.

The effects of changes of these conditions on cotton fabrics treated with other finishing agents are summarized in the Figures 1-5. Figure 1 shows the effect of time of aftermercerization with 20% sodium hydroxide at room temperature (27°C) on untreated cotton and on cotton cloth treated with methylated methylolmelamine and with dimethylol cyclic ethyleneurea. The influence of the finishes on the rate and extent of mercerization which was carried out slack, is indicated by the shrinkage of the fabric in the caustic solution. The stabilizing effect of the finishes is apparent. Aftermercerization of the resin-treated fabrics is thus much slower than mercerization of native cellulose.

The sodium hydroxide solution used must be of mercerizing strength to

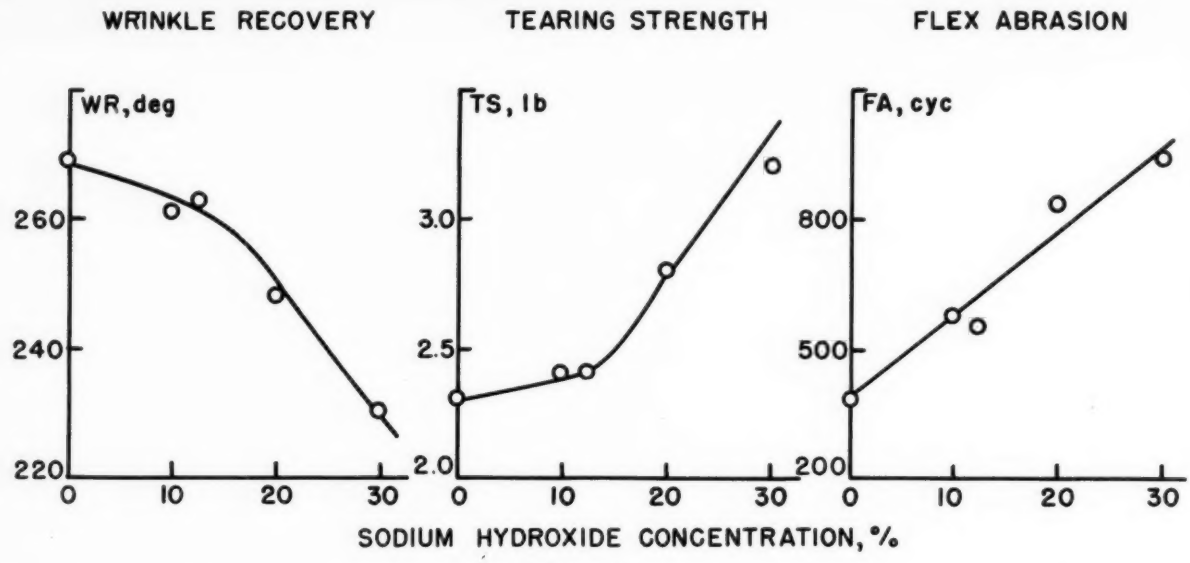

Figure 2
Effect of variation of the concentration of sodium hydroxide solution on the wrinkle recovery, tearing strength and flex abrasion of cotton print cloth finished with methylated methylolmelamine.

yield the full benefits of the aftertreatment. In Figure 2 are shown data obtained on the aftertreatment of cotton print cloth finished with methylated methylolmelamine. Concentration of the caustic solution was varied from 10-30% and fabric was held to original dimensions during treatment. Increasing the concentration of alkali resulted in greater loss of wrinkle recovery, but it was not until concentrations of mercerizing strength were used that substantial improvements in tearing strength were obtained. Improvements in flex abrasion appeared to follow a straight line relationship with the concentration of sodium hydroxide solution used in the aftertreatment.

The temperature of aftermercerization must be carefully controlled. Figure 3 shows the loss of resin caused by aftermercerization with 20% sodium hydroxide solution at temperatures ranging from 10° to 80°C (50° to 176°F). Only above room temperature (about 27°C) is the hydrolysis sufficiently rapid to cause appreciable loss of resin and consequently serious diminution of wrinkle recovery.

The add-on of resin influences the ability of the finished fabric to respond to the aftertreatment. Cotton print cloth with various add-ons of a commercial triazone resin was aftermercerized at room temperature with 20% sodium hydroxide holding the fabric at original dimensions, Figure 4. Below 10% add-on, definite improvements in tearing strength were obtained; however, above this add-on, there was no improvement from aftermercerization. Presumably, the resin has completely filled the accessible regions, which allows little or no penetration by the alkali and consequently little mercerizing action takes place.

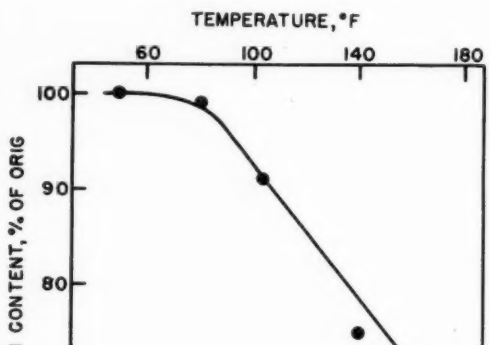

Figure 3
The effect of temperature of aftermercerization on the loss of resin of cotton print cloth with 4.6% methylated methylolmelamine.

DURABILITY OF THE EFFECTS OF AFTERMERCERIZATION —— Print cloth treated with methylated methylolmelamine, four percent add-on, was aftermercerized at original dimensions with 20% sodium hydroxide at room temperature. Before mercerization, wrinkle recovery was 274° (W+F) and tearing strength, 1000 g (W+F). The aftertreatment changed these to 242° and 1280 g, respectively. Durability of the properties is indicated by the curves of Figure 5, which were obtained by plotting the wrinkle recovery and tearing strength against the number of repeated laundry cycles. This laundering was carried out in an automatic homewasher using a commercial detergent.

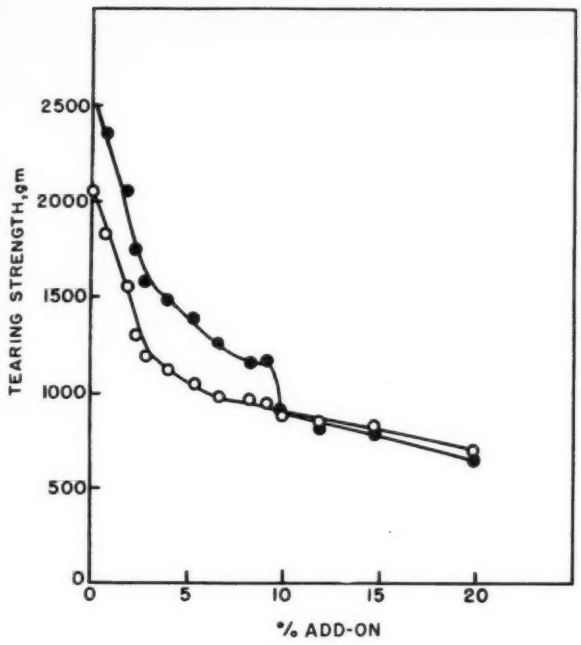

Figure 4
Tearing strength (W+F) of cotton print cloth treated with a commercial triazone finishing agent (O), and the same cloth aftermercerized (●).

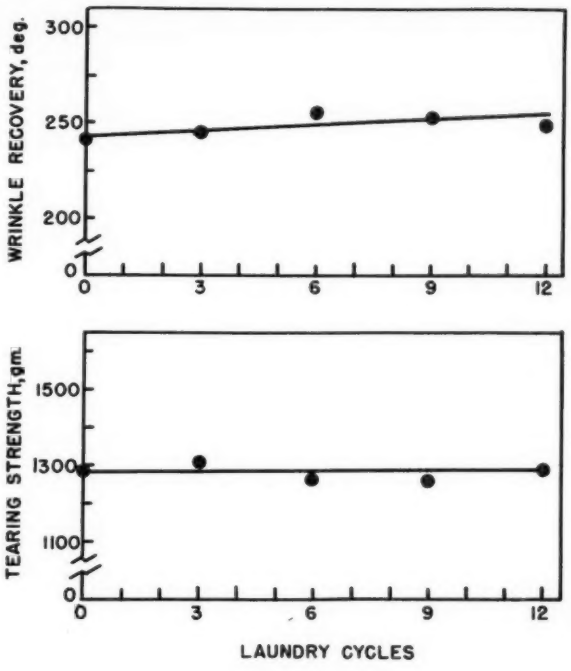

Figure 5
Durability to home-type laundering of the properties of cotton print cloth treated with methylated methylolmelamine and aftermercerized.

In addition, two other samples of print cloth, one treated with dimethylol cyclic ethyleneurea and one treated with a commercial triazone finishing agent, were mercerized, and subjected to the home laundry procedure with tumble drying. Their appearance was essentially the same as that of their resin-treated controls which were laundered along with them. Thus, aftermercerization does not greatly affect either durability or appearance of wash-and-wear finished cotton when subjected to home laundering.

AFTERMERCERIZATION OF WRINKLE-RESISTANT COTTONS ——— As was previously established with methylolmelamine-treated cotton (*9*), the present work indicates the most favorable conditions of aftermercerization are with 20% sodium hydroxide at room temperature with the fabric held at original dimensions. Cotton cloth treated with various finishing agents was mercerized, and the properties determined. The duration of the aftertreatment was set at 20 min to assure sufficient time for the caustic treatment to be effective.

TABLE I

Properties of 80x80 cotton print cloth treated with widely used nitrogenous finishing agents and aftermercerized

Treatment of fabric, add-on	*% N*	*Tearing strength (gm)*		*Flex abrasion (cyc)*		*Breaking strength (lb)*		*Stiffness (×10⁻⁴ in-lb)*		*Wrinkle recovery (deg)*		*Chlorine damage (% orig str ret)*
		W	*F*	*W*	*F*	*W*	*F*	*W*	*F*	*W*	*F*	
None (untreated cotton)	———	1140	827	1625	1130	44.1	35.9	3.8	1.9	95	89	99
Same, aftermercerized[1]	———	1180	833	1325	825	43.5	34.7	5.1	2.9	98	95	109
Urea-formaldehyde-treated (4.3%)[2]	1.99	500	253	80	110	30.2	18.5	4.4	2.2	143	136	36
Same, aftermercerized[1]	1.77	613	413	230	265	29.5	21.8	4.3	2.2	128	124	15
Ethyleneurea-treated (3.7%)[3]	1.21	540	333	115	75	27.8	21.6	3.8	1.8	147	148	94
Same, aftermercerized[1]	1.13	747	353	170	100	26.6	20.9	3.6	1.6	144	137	51
Triazone-treated (4.3%)[4]	1.19	640	413	180	90	27.1	19.5	3.6	2.0	151	147	91
Same, aftermercerized[1]	1.12	707	433	220	160	29.1	21.5	3.7	2.3	139	133	84
Melamine—formaldehyde-treated (4.8%)[5]	2.17	607	347	140	90	31.4	21.7	4.4	2.0	143	139	95
Same, aftermercerized[1]	2.14	667	420	270	360	33.5	24.5	4.4	2.4	136	132	93

[1] Aftermercerized at original dimensions with 20% sodium hydroxide solution at room temperature (27° C) for 20 min
[2] Freshly prepared dimethylolurea
[3] Dimethylol cyclic ethyleneurea (Rhonite R-1)
[4] A commercial methylolated triazone derivative
[5] Methylated methylolmelamine (Aerotex M-3)

TABLE II

Aftermercerization of 80x80 cotton print cloth finished with triazone derivatives

Triazone finishing agent	Finished fabric: Add-on (%)	Finished fabric: Tear str W+F (gm)	Finished fabric: Wr recovery W+F (deg)	Finished and aftermercerized fabric: Tear str W+F (gm)	Finished and aftermercerized fabric: Wr recovery W+F (deg)
Dimethylol ethyl triazone	3.8	973	273	1153	246
Dimethylol hydroxyethyl triazone	4.2	1006	269	1240	240
Tetramethylol ethylene bis-triazone	4.0	1153	250	1360	223
Commercial triazone finishing agent	4.3	1053	298	1140	272

TABLE III

Aftermercerization of 80x80 cotton print cloth treated with methylolated acetylenediurea

Treated with methylolated acetylenediurea: N content of fabric (%)	Tearing strength W+F (lb)	Wrinkle recovery W+F (deg)	Treated with methylolated acetylenediurea and aftermercerized: N content of fabric (%)	Tearing strength W+F (lb)	Wrinkle recovery W+F (deg)
(Untreated)	4.8	174	—	—	—
0.2	3.3	223	0.2	4.1	217
0.4	3.1	223	0.4	4.0	211
0.9	2.8	245	0.9	3.3	240
1.1	2.4	262	1.0	3.1	246

TABLE IV

Aftermercerization of 80x80 cotton print cloth treated with epoxy finishing agent

Add-on (%)	Epoxy finished[1]: Tearing strength, warp (gm)	Epoxy finished[1]: Flex abrasion, warp (cycles)	Epoxy finished[1]: Wrinkle recovery, warp (deg)	Epoxy finished-aftermercerized: Tearing strength, warp (gm)	Epoxy finished-aftermercerized: Flex abrasion, warp (cycles)	Epoxy finished-aftermercerized: Wrinkle recovery,[1] warp (deg)
Untreated	655	940	87	—	—	—
1.5	240	490	115	330	650	103
2.7	195	450	117	310	600	106
5.4	180	410	125	330	555	115
7.9	170	385	137	265	500	121
10.1	135	410	145	265	460	128

[1] Fabric treated with various concentrations of Eponite 100 using zinc fluoborate catalyst.

NITROGENOUS FINISHING AGENTS——The most widely used finishing agents of the textile industry today are the methylolamide and methylolamine resins (*15*). Among these are: urea-formaldehyde, methylated methylolmelamine, dimethylol cyclic ethyleneurea and methylolated triazone derivatives. Some data on the aftermercerization of fabric treated with these materials have been given in the preceding sections. In Table I, however, is given a summary of the properties before and after mercerization, of samples of print cloth treated with these finishing agents.

Tearing strength and flex abrasion resistance are improved by aftermercerization. Breaking strengths of all but the sample treated with dimethylol cyclic ethyleneurea were likewise improved. Some stiffness imparted by the resin treatment was, in many cases, lessened. Wrinkle recovery was decreased somewhat, but remained sufficiently high for good crush resistance.

Chlorine retention of ethyleneurea-treated cotton is adversely affected by the aftermercerization. The aftertreatment apparently causes resin hydrolysis which results in loss of about 50% of the strength due to chlorine damage when tested by the AATCC method (*16*). Urea-formaldehyde-treated cotton is similarly affected. The triazone and melamine finishes are more resistant to alkaline hydrolysis and the chlorine retention of these fabrics is not greatly changed by the aftertreatment.

The triazone used was a commercial product believed to be dimethylol ethyltriazone. This, however, could not be positively ascertained. Therefore, since three pure triazone derivatives were available at this Laboratory in connection with other research (*17*), the methylol derivatives of ethyltriazone, hydroxyethyltriazone, and ethylene bis-triazone were prepared and applied to cotton print cloth. More correctly these methylolated triazones are: dimethylol tetrahydro-5-ethyl-s-triazin-2(1H)-one dimethylol tetrahydro-5-hydroxyethyl-s-triazin-2(1H)-one, and tetramethylol ethylene-5,5′-bis[tetrahydro-s-triazin-2(1H)-one], respectively. The treated fabrics were aftermercerized, producing the results shown in Table II.

The finishes, in their responses to aftermercerization, were comparable to those of the commercial product, although wrinkle recovery angles were somewhat lower.

Another nitrogenous finishing agent which was studied was tetramethylol acetylenediurea. Table III shows the results obtained on the aftermercerization of a series of samples of print cloth treated with this finishing agent. Although the data in this table show promising improvement in properties, work with this resin was subsequently abandoned because of poor reproducibility of results obtained in its application to cotton.

NONNITROGENOUS FINISHING AGENTS——There is a great deal of interest currently in nonnitrogenous finishing agents for cotton (*18-21*). Their appeal lies primarily in their general resistance to chlorine damage. However, except for formaldehyde, which has long been considered potentially valuable for application to textiles, most agents of the nonnitrogenous class are relatively new developments and are in little commercial usage. Nevertheless, they could become important very quickly and were included in the study to determine whether aftermercerization could help the properties of fabrics treated with such agents.

Large losses of strength occurred when a diepoxide finishing agent was applied to cotton cloth with zinc fluoroborate catalyst. Using this catalyst, the treatment of cotton with Eponite 100, which is believed to be principally the 1,3-diglycidyl ether of glycerol, caused a loss of about 70% of the original tearing strength on fabric with useful wrinkle resistance. It is believed that the magnitude of this loss is due primarily to acid degradation rather than to the effect of crosslinkage.

Aftermercerization will increase the tearing strength and abrasion resistance of such epoxy-finished cottons (Table IV). While there was definite

TABLE V

Aftermercerization of 80x80 cotton print cloth treated with various nonnitrogenous finishing agents

Finishing agent	Conditions of curing: Catalyst	Time (min)	Temp (°C)	Finished fabric: Add-on (%)	Tear str W+F (gm)	Flex abr W+F (cycles)	Wr rec W+F (deg)	Finished–aftermercerized fabric: Tear str W+F (gm)	Flex abr W+F (cycles)	Wr rec W+F (deg)
Formaldehyde	$Zn(NO_3)_2$	4	160	0.9	653	75	279	760	120	247
Glyoxal	H-7	4	160	0.9	1160	1245	240	1380	1490	211
Glutaraldehyde	H-7	4	160	2.3	806	460	286	1047	590	269
α-Hydroxyadipaldehyde	H-7	4	160	1.0	1034	820	264	1207	1050	243
Pentaerythritol acetal (Quaker Reactant 82)	MX	4	160	3.1	586	75	277	693	135	247
Acetone-formaldehyde	NaOH	4	160	2.1	1067	795	231	1507	1015	168

improvement in these properties, it is believed that these improvements were not sufficient to overcome the severe losses brought about by the finishing process and give an acceptable product.

Other catalysts for epoxy treatments are now under investigation at this Laboratory. Some appear to be more attractive for use in the finishing of cotton because of less serious strength losses with good wrinkle resistance (*22*).

One catalyst which appears to be effective in applying an epoxy finish to cotton is phthalic anhydride. Using this catalyst with Eponite 100, a sample of print cloth was prepared with 9.7% add-on and a wrinkle recovery of 252° (W+F). A rather large amount of anhydride was necessary, about 40% of the weight of the epoxy used. It was apparently bound to the cellulose with the epoxy compound through ester linkages. This finish, however, could not withstand aftermercerization which apparently saponified the ester linkages, resulting in loss of all the added wrinkle resistance. Other nonnitrogenous finishes were more successfully aftermercerized.

As mentioned above, formaldehyde is deemed a potentially valuable finishing agent for cotton. Methylene bridges crosslink the cellulose chains and give good wrinkle resistance. However, use of this treatment has not been reported on a plant scale. Aftermercerization improves the strength and abrasion resistance of formaldehyde-treated cotton as indicated in Table V.

The table also indicates results obtained on treatment of print cloth with three dialdehydes —— glyoxal, glutaraldehyde, and α-hydroxyadipaldehyde —— and on aftermercerization of the treated fabric. Glutaraldehyde and α-hydroxyadipaldehyde could be attractive for textile finishing if a method of avoiding the yellow color acquired in curing could be perfected. The color, which is probably due to oxidation and formation of polymerization products in side reactions, is heightened by aftermercerization. Tearing strength and abrasion resistance are improved as usual.

Pentaerythritol acetal, which is one of a series of new textile reactants, as reported by Irvine and Kress (*19*), was investigated, also. This reactant causes appreciable strength losses in imparting wrinkle resistance. Part of the strength loss, as well as that of abrasion resistance, is recovered by aftermercerization, Table V.

A condensate of acetone and formaldehyde was prepared and applied to cotton as described in the patent literature (*23*). The reaction with cotton, catalyzed by sodium hydroxide, produced moderate wrinkle resistance, Table V. Aftermercerization with 20% sodium hydroxide apparently resulted in almost complete hydrolysis of the finish from the cotton as evidenced by loss of wrinkle resistance back to that of the untreated print cloth.

EFFECT OF FABRIC CONSTRUCTION

All of the above work was carried out on 80 x 80 cotton print cloth. An opportunity was presented to investigate the effects of variations in fabric construction on the response of the resin-finished material to aftermercerization. A series of cotton fabrics, which had been used at Fabric

TABLE VI

Aftermercerization of cotton fabrics of varied construction treated with dimethylol cyclic ethyleneurea

Weave	Fabric construction: Wt oz/sq yd	Yarns per inch: W	Yarns per inch: F	Yarn size: W	Yarn size: F	Twist multiplier: W	Twist multiplier: F	Ethyleneurea finished: Add-on (%)	N (%)	Tearing strength (gm): W	Tearing strength (gm): F	Wrinkle recovery (deg): W	Wrinkle recovery (deg): F	Finished and aftermercerized[1]: N (%)	Tearing strength (gm): W	Tearing strength (gm): F	Wrinkle recovery (deg): W	Wrinkle recovery (deg): F
Plain	2.83	64	64	30/1	30/1	4.0 Z	4.0 Z	6.6	1.36	433	300	147	147	1.34	540	407	124	128
Plain	2.40	64	48	30/1	30/1	4.0 Z	4.0 Z	6.0	1.40	413	280	144	153	1.37	673	500	132	137
Plain	3.14	64	48	30/1	18/1	4.0 Z	4.0 Z	6.2	1.49	387	453	149	144	1.44	527	670	125	131
Plain	3.18	64	80	30/1	30/1	4.0 Z	4.0 Z	5.6	1.38	387	313	150	139	1.38	500	393	135	128
Plain	2.67	64	80	30/1	42/1	4.0 Z	4.0 Z	5.8	1.43	413	200	144	150	1.36	573	280	135	135
Plain	2.87	64	64	30/1	30/1	4.0 Z	4.0 Z	6.0	1.44	400	260	138	157	1.40	513	380	130	131
Plain	2.82	64	64	30/1	30/1	4.0 Z	3.0 Z	6.0	1.39	440	273	143	147	1.38	540	400	126	135
Plain	2.78	64	64	30/1	30/1	4.0 Z	3.5 Z	5.9	1.41	427	267	147	147	1.37	567	420	121	137
Plain	2.83	64	64	30/1	30/1	4.0 Z	4.5 Z	6.2	1.45	393	287	149	142	1.39	540	400	133	133
Plain	2.87	64	64	30/1	30/1	4.0 Z	5.0 Z	6.3	1.46	373	307	151	139	1.39	487	387	133	123
Plain	5.04	64	64	18/1	18/1	4.0 Z	4.0 Z	5.9	1.43	580	513	140	141	1.32	773	673	122	125
Plain	3.80	64	64	18/1	30/1	4.0 Z	4.0 Z	6.0	1.44	[2]	273	139	149	1.37	840	347	127	143
Plain	1.97	64	64	42/1	42/1	4.0 Z	4.0 Z	6.2	1.44	333	207	152	144	1.40	540	373	129	140
Plain	2.48	64	64	42/1	30/1	4.0 Z	4.0 Z	5.9	1.40	313	327	151	147	1.32	407	473	136	136
Oxford	2.81	64	64	30/1	30/1	4.0 Z	4.0 Z	6.1	1.47	820	407	149	144	1.42	1300	633	129	134
Oxford	4.98	64	64	18/1	18/1	4.0 Z	4.0 Z	6.6	1.50	1013	580	147	146	1.47	1467	873	123	126
Oxford	2.02	64	64	42/1	42/1	4.0 Z	4.0 Z	5.8	1.47	700	333	151	146	1.30	1350	693	140	126
2/1 Twill	2.78	64	64	30/1	30/1	4.0 Z	4.0 Z	5.9	1.46	467	320	148	144	1.45	713	520	128	132
2/2 Twill	2.77	64	64	30/1	30/1	4.0 Z	4.0 Z	6.1	1.52	613	400	150	141	1.44	813	567	129	132
3/1 Twill	2.76	64	64	30/1	30/1	4.0 Z	4.0 Z	6.1	1.51	580	367	151	148	1.44	907	607	129	126
3/1 Twill	4.75	64	64	18/1	18/1	4.0 Z	4.0 Z	6.3	1.52	693	593	145	154	1.42	1013	833	122	144
3/1 Twill	1.90	64	64	42/1	42/1	4.0 Z	4.0 Z	6.2	1.48	613	340	150	155	1.41	947	640	139	139
2 × 2 Basket	2.79	64	64	30/1	30/1	4.0 Z	4.0 Z	5.6	1.35	1047	613	146	144	1.28	1783	1483	130	141

[1] Samples aftermercerized at original dimensions with 20% sodium hydroxide solution at room temperature for 20 minutes
[2] Tore across fill

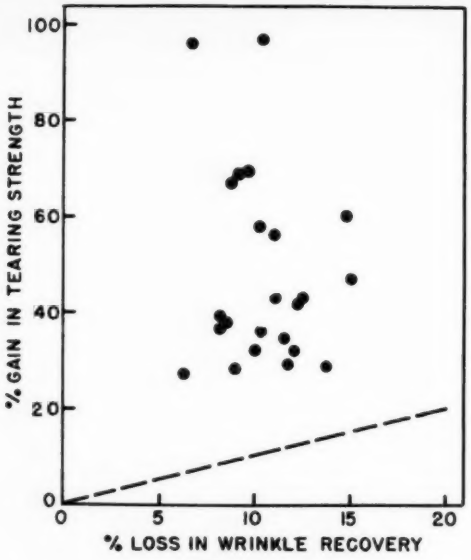

Figure 6
Plot of increase in tearing strength (W+F) versus loss in wrinkle recovery (W+F) obtained on aftermercerization of 23 cotton fabrics of different constructions which had been finished with dimethylol cyclic ethyleneurea. Broken line indicates equal gain of strength and loss of wrinkle recovery.

Research Laboratories, Inc, as part of another study undertaken through a Department of Agriculture research contract, was made available to investigators at this Laboratory. The materials had been specially woven, varying only one parameter of construction on each fabric. The fabrics are listed in Table VI. Samples of the fabrics were treated with dimethylol cyclic ethyleneurea. Add-ons were a little higher than are usually desired for cotton finished with this resin. The properties obtained on finishing and on aftermercerization of the finished samples are shown in the table.

An interpretation of the effects of construction on the properties attained in resin treatment is beyond the scope of the present paper. However, the data are being analyzed statistically and this will be a part of a future publication (*24*).

It can be seen that, in every case, an increase in tearing strength was achieved by aftermercerization. Further, loss of resin and decrease in wrinkle recovery were small. In Figure 6, are shown the points obtained when the percent loss in wrinkle recovery (W+F) is plotted against the percent gain in tearing strength (W+F). All points fall above the broken line which indicates an equal gain in strength and loss in wrinkle recovery. The wide spread of points along the ordinate is undoubtedly due to factors involved in the geometry of fabric construction.

SUMMARY

This continuation of a study of the aftermercerization of wrinkle-resistant cotton fabrics shows that the aftertreatment will effectively improve the tearing strength and abrasion resistance of fabrics treated with a number of finishing agents. These improvements are achieved with a small loss of wrinkle recovery. However, the gains in tearing strength and abrasion resistance, which are durable to laundering, appear to outweigh the loss of wrinkle resistance.

Cotton fabric treated with a variety of finishing agents, both nitrogenous and nonnitrogenous, were investigated. The only finishes adversely affected by aftermercerization were those which are particularly subject to alkaline hydrolysis. Acetone-formaldehyde condensate is completely removed by mercerization while the chlorine retention of fabric treated with ethyleneurea or urea-formaldehyde is increased.

Investigation of the variables of aftermercerization indicated the importance of proper control of conditions of the treatment. Wrinkle-resistant cottons require longer time for mercerization than does native cotton. Temperatures much above 27°C must be avoided to obviate serious loss of resin. A concentration of sodium hydroxide of about 20% is necessary for the greatest gain in strength in proportion to the loss of wrinkle recovery. Properties of fabrics with too great a resin add-on are not improved by the aftertreatment, probably due to poor penetration by the alkali.

Response of ethyleneurea-treated cotton fabrics, of 23 varied constructions, to aftermercerization was observed. All of these fabrics gained in tearing strength with small loss of wrinkle resistance and resin content.

ACKNOWLEDGMENT

The authors wish to extend their thanks to the following for assistance in this investigation: to L W Mazzeno Jr for help in planning the study; to P C Mehta and Maurilio Leite de Araujo, Filho, who carried out some preliminary experiments on this study during a tour of duty at this Laboratory under the Point Four program of the International Cooperation Administration; to E James Stavrakas of Fabric Research Laboratories, Inc, Dedham, Mass, for providing the fabrics of various constructions; to members of the Product Evaluation group of this Division, and in particular, Julia M Sloan and Margarette Loughlin, for textile testing; to Julian F Jurgens for nitrogen determinations; and to George I Pittman for preparing the figures.

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37th National Convention———

ACRYLICS IN TEXTILE BINDING APPLICATIONS*

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The acrylics are a large and varied family of polymers having utility in a wide variety of applications. This paper covers a few of the many textile applications of acrylic polymers, emphasizing those which feature the binding properties of the polymer. Three such applications are backcoating, pigment binding, and bonding of nonwovens.

A nonwoven fabric is an assembly of fibers held together by means other than weaving or knitting. Acrylics are useful in five of the nine methods of bonding nonwovens.

Backcoating, as applied to upholstery fabrics, automative fabrics, and rugs, serves to lock the pile, prevent ravelling, add body and weight. Acrylics are most useful where resistance to heat and light is important, as for example in automotive fabrics, but they are attaining wide acceptance in other cases as well.

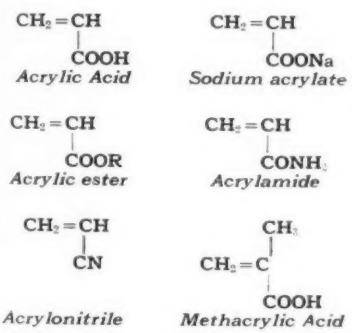
Pigment binding is a method of coloring fabrics by means of pigments bonded to the fibers with resins. Acrylics are usually thought of as anticrock agents, but certain acrylics also show considerable promise as primary binders.

In discussing these processes, an attempt is made to outline the requirements of the binder in each case, then show the extent to which acrylics are able to fulfill these requirements.

INTRODUCTION

THE acrylics are a large and varied family of polymers having utility in a wide variety of applications. The purpose of the present paper is to discuss a few of the many textile uses of acrylics, emphasizing those which feature the binding properties of the polymer.

By way of background, we might take a brief look at the acrylic monomers—the building blocks from which the polymers are constructed. Typical acrylic monomers include acrylic acid, methacrylic acid, and their salts, esters, amides, and nitriles:



etc.

By polymerization of a suitable mixture of such monomers, a polymer can be tailor-made to fit a specific end use. The selection of monomers and the chemistry of the polymerization are outside the scope of the present discussion. However, a few simple examples might be given to illustrate the many possible variations.

From the standpoint of fabric stiffness, polymers based primarily on esters and acrylic acid will be soft, and will impart a soft, full hand to the fabric. The higher esters, such as butyl and octyl acrylate, yield even softer polymers than do methyl and ethyl acrylate. On the other hand, stiff polymers may be produced by copolymerization with methacrylate esters, particularly methyl and ethyl methacrylate. Such copolymers impart a firm hand to fabric. This subject has been discussed in considerable detail in an earlier publication (*6*).

Polymer composition also determines the solubility. Thus, the acrylic esters yield water-insoluble polymers, but by copolymerization with sufficient acrylic acid, for example, a water-soluble (or alkali-soluble) polymer results (*4*).

For the most part, the acrylics may be regarded as linear or two-dimensional polymers. However, certain acrylic polymers may be crosslinked. Thus, carboxyl-containing polymers may be ionically crosslinked with, for instance, basic aluminum acetate or zinc oxide. This reduces tack and improves drycleanfastness, although washfastness is not improved. Polymers containing certain functional groups may be reacted with, for example, urea- or melamine-formaldehyde resins. This improves both wash- and drycleanfastness. Finally, certain acrylic polymers are self-crosslinking if cured. An example of this, and benefits to be derived therefrom, will be discussed in a later section. Such polymers might be regarded as thermosetting, but it should be emphasized that they usually maintain the flexibility characteristic of thermoplastic polymers.

In addition to the variety resulting from selection of monomers, acrylic polymers can also vary in the physical form in which the product is supplied. Thus, water-insoluble polymers may be prepared in solvent solution, in the form of an aqueous dispersion or latex, or, in some cases, as a dry powder (actually tiny beads). Each form has its specific uses.

Molecular weight can also vary. In the case of aqueous dispersions (or so-called emulsion polymers) the molecular weight is ordinarily very high—so high, in fact, that this is no longer a critical variable. For special uses, however, aqueous dispersions having considerably lower molecular weight can be prepared. By contrast, polymers prepared in solvent solution are invariably in the lower molecular-weight range. However, it is possible in some instances to convert an aqueous dispersion directly into a solvent solution. For example, emulsion polymers composed primarily of ethyl acrylate may be converted to a solvent solution by addition of certain specific solvents, such as isopropanol, tertiary butanol, or butyl cellosolve. Because of the high molecular weight of the polymer, such solutions are, of course, quite viscous.

For special purposes, aqueous dispersions can be prepared which are transposed to viscous solution form merely by addition of alkali. Certain other dispersions will thicken, but retain their emulsion (latex) form; this

* Presented by A C Nuessle on October 31, 1958, at the Conrad Hilton Hotel, Chicago, Ill, during the 37th National Convention.

is useful where increased viscosity is desired without use of a separate thickening agent.

As a final example of the variety to be found in acrylics, it might be mentioned that, in the case of the aqueous dispersions, in which the microscopic polymer particles are suspended in water, the dispersion may be anionic, nonionic, or (more rarely) cationic.

As a general class, the acrylics are resistant to discoloration and stiffening on exposure to heat and light. This property coupled with the variety of compositions and forms in which they are available, suggests that the acrylics should be useful in a large number of textile applications. Accordingly, acrylics have been proposed for such purposes as bodying and stiffening, delustering, enhancing crease recovery, coating of fabrics, backcoating of upholstery and rugs, bonding of nonwoven fabrics, warp sizing, and latex thickening (*1, 6, 7, 8, 9*).

The present discussion will cover only three of these applications: bonding of nonwovens, backcoating, and pigment binding. In each of these uses the acrylic serves, to some extent at least, as a binder. In discussing these processes, an attempt will be made to outline the requirements of the binder in each case, then to show the extent to which acrylics are able to fulfill these requirements. The discussion will be a general one, emphasizing principles of operation rather than technological details.

BONDING OF NONWOVENS

In a nonwoven fabric the fibers are held together by means other than knitting or weaving.

A primary advantage of a nonwoven over a woven fabric is simplicity of manufacture; that is, fewer processing steps are necessary. It will be recalled that the starting point for either a nonwoven or a woven staple fabric is a quantity of loose fibers. In the case of a woven fabric, the fibers must be carded, the card web must be drawn and twisted into yarns, the yarns made into warps, and (usually) the warps must then be sized before they can be woven.

In the case of a nonwoven fabric, most of the above operations are eliminated. For example:

a) The card web may be bonded directly. This gives a fabric having most of its strength in one direction.

b) The card web may be transversely doubled (ie, cross-lapped), then bonded. This tends to equalize the strength. It also is a common practice where thick webs are desired.

c) The web may be formed in random fashion, as for example by the Rando-web process, then bonded. This gives essentially equal strength in all directions.

For the sake of completeness, it might also be pointed out that in reclaiming woven fabrics by reprocessing them into nonwovens, a garnett is used. The same device may also be used to process loose fibers. The resulting web, in either case, is roughly equivalent to a card web.

There are at least nine methods of bonding nonwoven fabrics; these may be outlined as follows:

a) *Felting*: applicable only to wool or other scaly fibers.

b) *Needle punching*: sometimes used as the sole bonding means, and sometimes as a supplemental means, as for example to hold doubled card webs prior to coating or other treatments.

c) *Solvent bonding*: application of a fiber solvent or swelling agent to gelatinize the fibers, subsequently bonding by pressure.

d) *Thermoplastic fibers*: added to the fiber mass before forming the web, and later bonded by heat.

e) *Thermoplastic powder*: sifted into the web, then bonded by heat.

f) *Printing*: local application of thickened binder in the form of a printed stripe or other pattern.

g) *Padding*: more or less complete saturation of the web with a solution or dispersion of the binder; this is one of the most widely used methods of bonding thin webs.

h) *Spraying*: this gives a lower degree of bonding than does a pad application, but the resulting web is loftier.

i) *Foaming:* impregnating with a frothy mixture of binder and foaming agent; widely used for interlining.

This list is probably not complete. Thus for example, application of binder solution by means of kiss-roll might be regarded as a separate method, although for present purposes we shall consider it as a variation of printing (if the mix is thickened) or of padding (if essentially unthickened).

In any event, thermoplastic binders such as the acrylic polymers are useful in at least five of the above-listed bonding processes: foaming, spraying, padding, printing, and the powder technique.

POWDER——This method is best suited to thick webs such as those used for the padding or stuffing of upholstery. The binder must be in the form of free-flowing, discrete particles, small enough to penetrate by gravity through the web, yet large enough to be trapped at fiber crossovers. Particles of the order of two to five thousandths of an inch are ordinarily satisfactory. On heating, the particles must soften and adhere to the fibers, and so bind them together.

A dry, so-called "powdered acrylic"—actually fine beads, prepared by a special polymerization method—amply fulfills these requirements.

Usually 15% to 30% of polymer on the weight of the fibers is sufficient for adequate bonding. Webs so bonded maintain their loftiness, due to the discontinuous nature of the bonding. However, the effect is not as washfast as, for example, that obtainable through a saturation process.

PRINTING——This was one of the earliest forms of bonding nonwovens on a commercial scale. A typical end use is exemplified by disposable items such as dental bibs.

This method of bonding is most often applied to thin card webs, in which the fibers are oriented in the machine or long direction. The binder, suitably thickened, is printed on in the form of a stripe running transversely across the fabric. This bonds the fibers and also contributes strength in the "filling" direction.

For the very cheapest disposable items, a low-cost binder such as plasticized polyvinyl acetate is ordinarily adequate. The use of acrylic binders is likely to be restricted to items such as drapes and curtains, where an intricate printed pattern serves both as binder and as decoration. Although disposable, such items may often be kept for a considerable period of time, and perhaps may even be washed gently and re-used. Resistance to discoloration and stiffening, and freedom from plasticizer migration, make the acrylics an ideal choice in such an application.

PADDING —— In its various forms, padding is probably the most widely used method of bonding nonwovens. It is especially applicable to thin or moderately thick webs, for end uses requiring a very complete degree of bonding.

In such an application, the binder—usually in the form of a rather fluid water dispersion—penetrates into every portion of the web, saturating it. Because the unbonded web has low wet strength, it is usually supported on a wire or plastic screen during impregnation. Excess binder is removed by squeeze rolls, in some cases aided by vacuum extraction.

The bonded web will contain from 15% to as much as 50% of binder solids. Because of the thorough penetration, an excellent degree of bonding can be obtained. However, in the case of thick webs there is often a skinning effect due to migration during drying; for this reason the process is ordinarily confined to thin webs. Furthermore, as a result of the completeness of bonding, together with the flattening effect of the pad pressure, there is a reduction in loftiness; the web is flat and compact.

The flexibility of the bonded web will be proportional to the flexibility of the bonding agent. The acrylics family comprises a variety of polymers having a wide range of flexibility. Moreover, the flexibility is not diminished by laundering, drycleaning, or exposure to heat or light.

The chief purpose of the binder is to glue the fibers together. Dry strength is nearly always adequate, regardless of the choice of binder. But resistance to laundering or drycleaning varies considerably with the composition of the polymer. As an example, let us consider the bonding of an all-viscose web with two acrylic polymers: Rhoplex AC-33 (an aqueous dispersion of thermoplastic resin) and Rhoplex B-15. The binders were applied from a 25% solids solution at a wet pickup of 117%, dried at a low temperature and cured 10 minutes at 300° F. The resulting webs contained 23% binder solids and 77% fiber. Specimens of each fabric were then subjected to the following washing and drycleaning tests: a) Launder-Ometer, 10 minutes at 140° F, 0.05% soap plus 0.1% TSPP, with 10 steel balls; b) one full Sanforized wash, with ballast load; c) tumbling in perchlorethylene, and in d) Stoddard solvent, 20 minutes at room temperature. In the latter two cases, the solvents were charged with drycleaning soap and a little water as in AATCC Tentative Test Method 25-1952.

In assessing these results, we must bear in mind that AC-33 is widely noted as a paint vehicle for both indoor and outdoor use; its durability to weathering is excellent. However, as a binder for nonwovens which are to be subjected to hot tumble washing or to drycleaning solvent, it is much inferior to B-15.

TABLE I

Fastness tests on nonwovens bonded with Rhoplex AC-33 vs B-15

Test	*AC-33*	*B-15*
140°F Launder-Ometer wash	partly disintegrated	unchanged
Full Sanforized wash	disintegrated	slightly pilled
Perchlorethylene (charged)	disintegrated	unchanged
Stoddard solvent (charged)	unchanged	unchanged

The superiority of B-15 in this application is due to the fact that, on heating, it reacts with itself, and perhaps to a smaller extent with the fibers. Thus it can better resist the stresses encountered in wet-tumbling operations.

Such a crosslinked polymer will still swell in solvent, but will not dissolve. Solvent swelling can be further reduced by ionic cross-linking, through addition of basic aluminum acetate (one percent on weight of polymer solids) or zinc oxide (two to five percent on same basis). However, washfastness is not improved in this manner, and may, in fact, be reduced—probably because the ionic crosslinks interfere to some extent with covalent crosslinking.

Both washfastness and drycleanfastness of certain polymers can be increased by addition of urea- or melamine-formaldehyde resins. A typical mix will contain two to five percent resin solids on the weight of the B-15 solids. A small amount of acid catalyst is helpful, though not always necessary. As a result of the addition of thermosetting resin, the fabrics are also somewhat more resilient. On cotton viscose the strength is usually lowered in proportion to the amount of thermoset added; but on nylon/acetate webs the strength may actually increase, reaching a maximum between 98/2 and 95/5.

SPRAYING———If carried to the extreme, spraying would completely saturate the web and thus give a result similar to padding. However, spraying is usually a more superficial operation. It tends to give a discontinuous bonding, similar to powder, but more or less restricted to the surface. On thick webs, the inner portions are only lightly bonded, if at all, and so retain their loft and resilience. This effect may be further enhanced by bonding with heat alone, avoiding pressure that would flatten the web.

Spraying is frequently used to obtain a surface deposit of binder prior to dielectric heat sealing. A similar surface effect could also be obtained by a kiss-roll application.

Spraying is confined largely to end uses where wet durability is not required. Furniture padding or stuffing is often bonded in this way.

FOAMING———In this process, a polymer dispersion, suitably formulated, is aerated or otherwise converted into a foam which is then gravity-fed onto the web. The excess may be scraped off with a doctor blade, or the web may be run through squeeze rolls.

There are several modifications of the process. In one case, a single thickness of web is coated on one side and the excess removed with a blade; then foam is applied to the other side and the web is passed through squeeze rolls *(5)*. In another instance, two webs are first bonded separately, then "glued together" with foam. This is said to give a better result than would be obtained by bonding a single, thick web.

The foam process is claimed to give a product that is uniform, crease-resistant, and porous. The greater uniformity is no doubt due to reduced migration. The foam is usually a high-solids formulation containing binder, emulsifier, foaming agent, thickener, and perhaps also a crosslinker.

In extreme cases, where a high concentration of binder is used, the finished product may resemble crepe rubber reinforced with fibers. Such a product is useful for interlinings. Rubber latex is commonly used in this application. Where better aging characteristics are desired, an acrylic—crosslinked with a suitable thermosetting resin or reactant for greater resilience—may be used.

The two-ply or laminated nonwoven has been used for outerwear, such as dresses and skirts. Here, washfastness, drycleanfastness, and good aging characteristics are required. Certain acrylics have shown considerable promise in this application.

BACKCOATING

A backcoating is an application of a binder or binder-filler mixture to the back of a fabric for one or more of the following purposes: locking the pile; preventing ravelling, slippage, distortion or shrinkage; or adding body and weight. Backcoating is widely used on automotive and upholstery fabrics, on synthetic fur fabrics with a woven or knitted backing,

and on rugs. Common methods of backing include knife-coating, kiss-roll application, and—more rarely—spraying.

Many types of formulations are possible. On the very cheapest rugs, for example, starch-and-clay mixtures are sometimes used. More often, though, a thermoplastic polymer is used as the binder.

It is not unusual to find six or eight ingredients in a backcoating formulation. An upholstery backing may, for example, contain a majority of the following:

Thermoplastic binder (natural rubber, synthetic rubber, polyvinyl, or polyacrylic).
Crosslinking or vulcanizing additives (sulfur, zinc oxide, and accelerators in the case of rubber; thermosetting resin and catalyst in the case of certain functional acrylic polymers).
Filler (clay, calcium carbonate, titanium oxide for whiteness and opacity, barium sulfate for density, ferric oxide for color, etc).
Dispersant for the filler (if not already dispersed).
Wetting agent (for better penetration of non-absorbent fabrics).
Thickener (to control degree of penetration).
Alkali (for pH adjustment; greater stability of the mix).
Plasticizer (for greater softness and freedom from cracking at a high level of loading).
Antifoam (for obvious reasons).

The choice of an acrylic as the binder will be based on a number of considerations, such as the following:

1) *Resistance to heat and light*—acrylics are especially useful where resistance to yellowing and stiffening on exposure to heat and light are important requirements.
2) *Durability to washing and dry-cleaning*—acrylics vary from poor to excellent in this respect, as was shown in the case of nonwovens. Therefore the proper acrylic must be selected where durability is a factor. Most rubbers, if properly crosslinked, are usually quite durable.
3) *Whiteness of filled backings*—acrylics give good whites with low-cost carbonate filler, without need for excessive amounts of higher-priced titanium dioxide filler.
4) *Clarity of unfilled backings*—rubbers, both natural and synthetic, require filler. On the other hand, acrylics may be used as clear, unfilled backings where such are desired.
5) *Cost*—recent price reductions have put the acrylics in a much more favorable position than was the case some years ago.

Naturally, the requirements which dicate the choice of binder will vary considerably depending on the end use to which the backing is to be put. This will be discussed in the sections below.

AUTOMOTIVE FABRICS —— Textile fabrics used in automobile upholstery are subjected to sunlight of such intensity and duration that not only is considerable heat generated, but also the light itself may penetrate through to the backing. Under such conditions, the heat may stiffen the fabric, and the light may yellow it. The effect is all the worse if, as often occurs, there has been some strike-through of backing to the surface. The resulting yellowing is particularly intense where rubber latex is used as a binder. Because the acrylics are resistant to such changes, they are enjoying considerable use in backings for automobile upholstery.

Such backings may be clear or filled. The formulations may be simple or complicated. The following is an example of a very simple, but quite typical, clear backing formulation:

25% acrylic solids (eg, Rhoplex E-23)
0.5% ammonia (28%)
5% thickener (such as Acrysol ASE-60)
Balance water.

The backed fabric would ordinarily contain about two ounces per square yard of acrylic solids.

Filled backings would contain, in addition to the acrylic binder and other ingredients, McNamee clay or similar filler, to the extent of 20% to 50% on the weight of the acrylic solids. A typical formulation might include:

25% acrylic solids (eg, Rhoplex B-15)
10% McNamee clay
0.1% dispersing agent (eg, Tamol 731)
1% thickener (eg, Acrysol ASE-60)
qs ammonia (to pH 8.5)
qs antifoam.

Rhoplex resins E-23 and B-15 are widely used on automotive fabrics. They give soft, flexible films which maintain their flexibility even after long exposure to heat and light. Where flexibility at very low temperatures (eg, —20° F) is required, Rhoplex HA-1 is recommended by Rohm & Haas Co.

FURNITURE UPHOLSTERY —— —In the case of furniture fabrics, the requirements are often quite different. In many cases the construction of the fabric is such that it is necessary to back it immediately after weaving, before any wet processing is undertaken. If this were not done, the fabric would become badly distorted during dyeing. In such instances, the binder must have sufficient fastness to withstand the dyeing operation, which may run near the boil for several hours.

As was shown with nonwovens, it is not sufficient that the binder be insoluble. It must maintain its adhesion while being subjected to heat, moisture, and mechanical action. Many rubber formulations are sufficiently durable, and so are certain of the acrylics. Rhoplex B-15, properly cured, and Rhoplex HA-1, crosslinked with thermosetting resin, are examples of acrylic polymers that have the necessary fastness requirements to withstand most dyeing operations.

In the present discussion, we are primarily interested in the properties of the binder, and particularly of acrylic binders. However, we must bear in mind that the characteristics of a backcoating may vary considerably, depending on the types and amounts of other ingredients and on the conditions of application. Thus, in an unpublished laboratory study, the following variables were found to be of importance in improving the wet durability (as measured by a simulated dye-cycle) of an upholstery fabric backed with Rhoplex B-15:

1) Adequate cure.
2) Addition of thermosetting resin.
3) Addition of certain plasticizers or high-boiling solvents.
4) Type of thickening agent.
5) Type of filler.

Although adequate cure was the most important factor, the other factors exerted a significant influence, particularly when curing conditions were minimal. The action of a plasticizer (eg, Paraplex G-62) seems to be one of promoting film formation, since a high-boiling solvent such as butyl cellosolve will have the same effect.

As the effects noted may to some extent be specific to the particular acrylic polymer under study, we shall not dwell on them here. They are cited merely as an illustration of the fact that, whether we are making an automobile tire, baking a cake, or backcoating a fabric, each ingredient and each step in the process may exert an influence on the final result.

Returning to furniture fabrics, it must be admitted that resistance to heat and light is not as critical as is the case with automotive fabrics. Nevertheless, aging characteristics

cannot be overlooked completely, and here the acrylics have a distinct advantage.

A further advantage of acrylics is the fact that they are inert to dyestuffs containing copper; whereas latex, both natural and synthetic, is sensitive to such dyes.

RUGS———The backing of rugs falls into two general classes. With tufted rugs, the problems may be similar to those encountered with furniture upholstery fabrics. Such rugs are sometimes dyed after backing and durability requirements are therefore severe. Conventional carpeting poses a different problem; ordinarily the chief requirement is low cost. Rugs may contain 20 ounces or more of backing per square yard. Washfastness and aging requirements are usually not critical; therefore cost is the primary consideration. The concentration of filler is accordingly quite high.

Because of the cost factor, acrylics have not attained as wide a degree of acceptance in rug backing as they have in other backing applications. However, moderate-cost formulations such as those shown in Table II are arousing considerable interest. These backings are very resistant to cracking.

Snowflake Whiting is a ground calcium carbonate filler. Where lowest cost is more important than the ultimate in performance, it may be used at 250% to 300% loading. Other fillers may be used, but the details of the formulation, including the degree of loading, may have to be varied depending on the type of filler used, and particularly on its particle size.

Mix B, containing casein, is recommended where a stiffer backing is desired. At high levels of loading, this is often preferable to employing a stiffer Rhoplex resin.

PIGMENT BINDING

Pigment binding is a method of coloring fabrics by means of pigments fastened to the fibers with resinous binders. Unlike a dyestuff, a pigment need not have affinity for the fiber; wash- and drycleanfastness are imparted by the bonding agent. Therefore the selection of a pigment may be based on brilliance and lightfastness, which in many instances exceed that of the very best dyestuffs. Moreover, no oxidation and reduction processes are involved, and there are no problems of diffusion into the fiber.

Because of these advantages, and in spite of some obvious disadvantages, pigment binding is of considerable commercial importance. It has been claimed that over 50% of all print colors are of the bonded pigment type. By contrast, pigment dyeing has attained a much lower degree of acceptance, but interest is growing.

TABLE II

Typical acrylic rug-backing formulations

	A	B
Filler (70% slurry)*	67	63
Rhoplex B-15	50	50
Acrysol ASE-60	1.2	—
Casein (20% solution)	—	15
% Solids	60	54
% Loading (on binder solids)	200	200
Viscosity (cps)**	3000	4400

*The filler slurry may be prepared as follows:
23 parts water
7 parts Tamol 731 (10% solution)
70 parts Snowflake Whiting

**Using a Brookfield Viscometer (No. 4 spindle at 30 rpm) after a final pH adjustment to 8.0-8.5 with NH_4OH (28%). The ingredients are listed according to their order of addition to the mix.

Pigment binding systems have been classified by Chase *(3)* according to the type of liquid medium (water, solvent or both) and to the location of the binder and the pigment. His classification, slightly revised, is given below.

A) Solution systems, containing a single liquid phase:
   1) Aqueous type, comprising
      water as the liquid medium
      water-soluble binder
      pigment dispersed in the water solution of binder.
   2) Solvent type, comprising
      organic solvent as the liquid medium
      solvent-soluble binder
      pigment dispersed in the solvent solution of binder.

B) Emulsion systems, containing both oil and water phases:
   1) Oil-in-water type, comprising
      water as the external phase
      binder dissolved in the oil phase (droplets)
      pigment dispersed in either phase.
   2) Water-in-oil type, comprising
      organic solvent as the external phase
      binder dissolved in the solvent
      pigment dispersed in the solvent
      water, the internal phase, serving as the thickener.

It is possible for a pigment binding system to be quite simple, as for example the old albumen process, which comprised little more than pigment dispersed in a water solution of albumen. After application to fabric, the albumen binder was insolubilized by heat.

However, most present-day systems are much more complicated. For example, an oil-in-water dyebath might include most and perhaps all of the following ingredients:

Pigment—to provide color
Butylated melamine in solvent solution—as primary binder
Alkyd or polyester—for better color value, additional binding
Latex (rubber or acrylic)—for anticrock
Emulsifier for the butylated melamine
Dispersant for the pigment
Antimigration agent (for printing, this is replaced by thickener)
Alkali—for pH adjustment.

Mixtures like the above are multiphase colloidal systems of such complexity that it is often difficult to determine with certainty how the various solid phases (eg, pigment and latex particles) are distributed among the liquid (solvent and water) phases. A detailed consideration of the matter is outside the scope of the present discussion; it is mentioned merely as a reminder that, due to the complexity of the subject, general statements do not always hold true in specific instances.

Thus, it is sometimes contended that, for optimum binding, it is necessary that the pigment be in the solvent phase with the resinous binder; these are the so-called "flushed" colors. It has further been argued that the anticrock ingredient should also be in the solvent phase. This may be true in some cases; but in other instances no improvement is shown by putting all of these ingredients into the same phase. This is one of the many questions that have not been adequately settled.

For the present, we are concerned only with the use of acrylic polymers in pigment binding. The discussion will be in two parts: a) acrylics as anticrock agents, and b) acrylics as primary binders. Where examples are given, they will be based on formulations that have purposely been kept as simple as possible.

ACRYLICS AS ANTICROCK AGENTS———Probably the greatest single difficulty with pigment-dyed fabrics is crocking—the transfer of color to another fabric rubbed against it. Fabrics colored with resin-bonded pigments are particularly susceptible to rub-off of color because the pigment is on the surface of the fibers, rather than inside them as in the case of dyed fabrics. In many instances, those resin binders having the best wash- and drycleanfastness are the ones most susceptible to crocking.

It has been known for many years that crocking can be greatly reduced by addition of a thermoplastic poly-

mer to the pigment-binder mix. Rubber latices, particularly of the butadiene-acrylonitrile type, are customarily used. However, these suffer from a serious defect: they become quite yellow on exposure to light. As a result, considerable study has been made of the use of acrylics in this application.

At the outset, it might be thought that any soft elastomer would be an efficient anticrock agent, but this is far from true. Acrylics vary from poor to very good in this respect.

As a general rule, the best butadiene copolymers are somewhat more efficient than the best acrylics. This is illustrated by the data in Table III, which compares an acrylic anticrock agent (Experimental Dispersion DS-874) with a commercial butadiene-acrylonitrile latex. The primary binder was Experimental Resin QR-401B, a nonacrylic thermosetting polymer which is self-dispersing in water. Pigment dyeings were made using the following formulation (all concentrations are % solids in bath):

0.50% Monastral Blue BFR
1.00 Experimental Resin QR-401B
0.50 to 1.00 anticrock agent
0.05 Triton X-100
0.075 Keltex S
qs Water (pH 8 to 9 with NH_4 OH)

As a reference standard, an application of a commercial pigment dyeing system was made, using such concentrations of color and pad emulsions as to obtain approximately the same original color value.

Cotton fabrics were padded at 70% wet pickup, dried and cured 10 minutes and subjected to the following tests: one, three and five full Sanforized washes, with ballast load of towels; 50 hours Fade-Ometer exposure, followed by one full Sanforized wash; and a standard 10-cycle crock test (AATCC 8-1952). Depth of shade was determined by reflectance measurements, using the Kubelka-Munk equation to convert to amount of color (K/S). From the change in K/S values, % color retention was calculated.

From the data, it will be observed that the dyeing made with the binder alone (Trial 1) shows a moderate level of crocking. This degree of crocking is not excessive when we note (Trial 6) that a typical commercial system will often crock this much. Even so, marked improvement is made on addition of a suitable acrylic or rubber anticrock, with the latter being somewhat more efficient.

While crocking should preferably be as low as possible, other factors enter the picture. Fabrics containing a rubber anticrock agent tend to go yellower and duller on cyclic aging (ie, ultraviolet exposure followed by washing), whereas fabrics containing acrylic anticrock agents, such as DS-874, retain their hue and brightness. Taking into consideration all of the factors — washfastness, lightfastness, and crocking, as well as many other criteria not herein evaluated — it would seem that the use of a suitable acrylic anticrock agent has definite merit.

TABLE III

Comparison of two anticrock agents

Trial No.	Binder and anticrock (% Solids)	Washfastness % Color retained after: 1 FSW	5 FSW	Lightfastness 50 Hours Fade-Ometer followed by: No Wash	1 FSW	Dry crocking (% Color transferred)
1	1% QR-401B alone	100+	81	97	88	3.7
2	Same + 0.5% DS-874	100+	94	100	94	2.1
3	Same + 1.0% "	100+	95	97	92	1.6
4	Same + 0.5% Bu-An	100	78	95	82	1.6
5	Same + 1.0% "	100	84	94	83	1.0
6	Commercial pigment dyeing system	91	73	97	95	3.7

To some extent, the efficiency of an anticrock agent will vary depending on the formulation into which it is incorporated. Experimental Dispersion DS-874 has proved to be effective in a wide range of formulations. Other acrylics which have shown promise in specific instances include Rhoplex resins AC-33, B-15 and B-5.

ACRYLICS AS PRIMARY BINDERS——The primary binder in a pigment coloring system is that component responsible for most of the wash- and drycleanfastness. A wide variety of materials have been tried for this purpose, including water-soluble and solvent-soluble, thermoplastic and thermosetting types. The patent literature is very voluminous.

As a general rule, thermoplastic binders of all types are somewhat less efficient than the best of the thermosetting binders. For example, excellent durability as measured by tumble-washing tests can be obtained with a thermosetting binder (such as Binder QR-392 or Exp Resin QR-401B) using as little as two parts binder to one of pigment. For equal durability, the better thermoplastic binders may require four to eight parts binder per one of pigment. In fact, some thermoplasts will not provide good washfastness at any ratio.

There are some instances where this lower degree of efficiency is not objectionable. For example, where a suitable thermoplastic polymer is used as a washfast binder for a nonwoven fabric at a level of say, 25% binder solids on weight of fiber, the incorporation of 0.5 to 1% pigment into the binder mix will yield a colored fabric having excellent fastness properties. At the resulting binder-to-pigment ratio of 25:1 or 50:1, both washfastness and crock-resistance will be outstanding. The only additional cost will be that of the pigment, since the thermoplastic binder would be used anyway.

But there are also certain potential advantages to using aqueous thermoplastic dispersions (ie, emulsion polymers) as primary binders at more normal levels. For example:

1) Ease of mixing, as such products disperse instantly in water.
2) The same polymer might function as the sole binder (ie, serve as both primary binder and anticrock).
3) There is evidence that certain acrylic polymers have outstanding scrub-resistance, particularly to hand scrubbing (so-called "knuckle test").
4) Certain polymers may be thickened by simple addition of ammonia, for use in printing.

As a result, considerable attention is being directed toward the use of acrylics as primary binders, and perhaps even as sole binders.

A great many acrylic polymers have been systematically evaluated, and much has been learned about the relationship between chemical composition of a polymer and its properties as a pigment binder. There are many end-use requirements—washfastness, drycleanfastness, lightfastness, crock resistance (both dry and wet), scrub resistance (which does not always correlate with wet crocking), and the like. As a result, the designing of a single polymer having all the desired features is a very complex undertaking.

A detailed account of the subject is beyond the scope of the present brief discussion. For the present, we shall summarize the status of acrylics as follows:

1) Not all acrylics show promise as binders. An example of an acrylic having unusually poor

TABLE IV

Acrylic polymers as primary binders and as sole binders in pigment dyeing systems

Trial No.	Thermoplast[a] (% Solids)	Washfastness % Color retained after: 1 FSW	5 FSW	Lightfastness 50-hour Fade-Ometer followed by: No Wash	1 FSW	Dry crocking % Color transferred
1	5% CL-2668	56	39	93	70	5.8
2	5% DS-874	82	70	98	88	0.9
3	5% Bu-An	75	63	98[c]	63[c]	1.0
4	1% DK-1041[b]	94	81	100	94	2.7
5	1% CL-2103[b]	89	81	98	89	2.7
6	1% Rhoplex HA-1[b]	98	82	98	87	4.5
7	" " +1% DS-874[b]	100	86	100	93	2.2
8	" " +1% Bu-An[b]	84	80	93[c]	76[c]	2.5

[a]In each case, 0.5% Monastral Blue BFR, 0.05% Triton X-100, 0.075% Keltex S (all on solids basis) were included, and the dilution water was adjusted to pH 8-9 with ammonia.
[b]In these trials 0.20% Aerotex MW, 0.07% Catalyst AC, and 0.1% NH_4OH (all on solids basis) were added as crosslinking agents.
[c]These treatments yellowed.

binding properties is given in Table IV, Trial 1. For simplicity, only three fastness tests are shown, but this particular polymer is also poor in dryclean fastness, wet crocking, and scrubfastness.

2) A few polymers having superior crock resistance are also fairly good as sole binders if used at high concentration. Experimental Dispersion DS-874, previously cited as an anticrock agent, is one of these. See Table IV, Trial 2. Comparative data are also given on a commercial butadiene-acrylonitrile anticrock agent (see Trial 3). It might be mentioned that DS-874 gives a rather stiff hand at the five percent solids level; this is another variable that must be kept in mind in designing pigment binders.
3) Best washfastness at a low binder level is attained through the use of a minor amount of a supplemental crosslinker. A formulation comprising (on a solids basis) one percent of a suitable thermoplastic polymer, 0.2% of a methoxymethyl melamine, and 0.07% of an amine hydrochloride catalyst will give the interesting results shown in Table IV, Trials 4 and 5. Incidentally, the thermoplasts cited here are DS-874 types, but softer; so that at the one percent level there is negligible increase in hand over that of the untreated fabric.
4) Where a thermoplastic primary binder yields good washfastness properties but has poor crock-resistance, it may be used in mixture with another thermoplastic having better anticrock properties. An example is shown in Table IV, Trials 6 to 8. Here the primary binder was Rhoplex HA-1, which not only provides reasonably good washfastness but also superior scrubfastness, as for example in the "knuckle-test" (data on this qualitative test are not given in the table). However, crocking is too high. This can be reduced considerably by addition of a second thermoplast having good anticrock properties, as shown in Trials 7 and 8. Incidentally, it will be noted that in the two instances where comparisons are possible in Table IV, DS-874 is fully equivalent to the commercial butadiene-acrylonitrile polymer (Bu-An) as an anticrock, and superior in the other properties.
5) The use of acrylics as primary binders is a relatively new concept, and has not received as much field study as has the use of acrylics as anticrock agents. It is too early to say whether acrylic polymers will prove to have any real commercial advantages over the more traditional nitrogenous resin binders. But from present indications, the acrylics deserve careful consideration in this use.
6) Less study has been made of printing than of dyeing; but here again the indications are that the acrylics have definite merit and warrant much further investigation.

Mention might also be made of combination dyeing and finishing processes. For example, soft acrylic polymers are often used as additives to nitrogenous-resin finishes for creaseproofing of cotton or rayon, for the purpose of improving the strength and enhancing the crease recovery. By incorporation of a pigment into such a system, pigment dyeing and finishing may be achieved in a single operation. Naturally, an antimigration agent must be incorporated, and the pH of the bath must be raised to 8-9, preferably with a mild nonammoniacal alkali, such as morpholine.

CONCLUSION

The foregoing discussion has covered three of the many possible textile applications of acrylic polymers: bonding of nonwovens, back-coating, and pigment binding. Acrylics are enjoying considerable use in the first two, and are being given critical evaluation in the third.

In discussing these applications, an attempt has been made to outline the requirements of the binder in each case, and to show the extent to which the acrylics are able to fulfill the requirements.

It has been emphasized that the acrylics are a large and varied family of polymers, not all of which will be equally efficient in a given end use. Therefore, it is important to select the proper polymer, and to use it in the right way.

Quite often, an available polymer will be found to have all the desired properties. In other instances, it will be necessary to design a polymer especially for the purpose.

As the commercial production of acrylic monomers is gradually extended to include types not now available, it should be possible to develop copolymers and interpolymers having outstanding utility in a variety of specific applications. In a few cases, at least, the overall effects may be difficult to obtain with nonacrylic materials.

REFERENCES

(1) Abrams and Sherwood, *Am Dyestuff Reptr* **43**, 780 (1954).
(2) Anon, *Textile Bull* **83**, No. 10, 57 (Oct 1957).
(3) Chase, "Textile Chemicals and Auxiliaries," Chapter 4, 2nd Edition, Reinhold Publishing Co, N Y (1957).
(4) Fordyce, Dupré, and Toy, paper presented at the American Chemical Society National Convention, San Francisco, April, 1958.
(5) Nottebohm, U S Patent 2,719,802 (to Pellon, 1955).
(6) Nuessle and Kine, *Ind Eng Chem* **45**, 1287 (1953).
(7) Steele and Browne, *Am Dyestuff Reptr* **45**, 525 (1956).
(8) Taylor, *ibid* **46**, 437 (1957)
(9) Taylor, *Textile Age* **106**, No. 9, 18 (Sept 1956).

TRADEMARKS

Rando-web—Curlator Corp
Rhoplex—Rohm & Haas Co
Acrysol—Rohm & Haas Co
Tamol—Rohm & Haas Co
Monastral—Du Pont Co
Triton—Rohm & Haas Co
Keltex—Kelco Co
Aerotex—American Cyanamid Co
Catalyst AC—Monsanto Chemical Co
Paraplex—Rohm & Haas Co

ACTIVITIES OF THE LOCAL SECTIONS

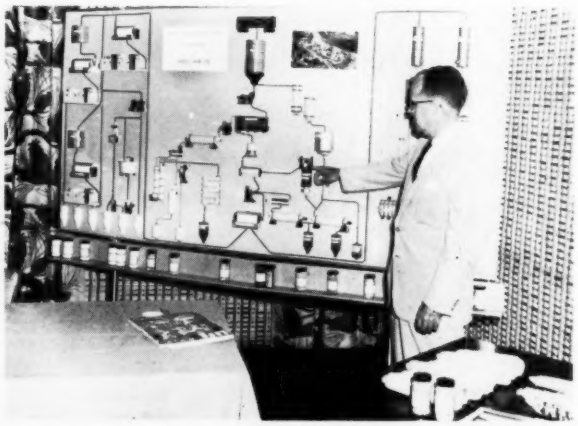
Meeting of the Southeastern Section
September 13, 1958 • Ida Cason Callaway Gardens, Pine Mountain, Ga
(See report on page P743 of October 20th issue)

SOUTHEASTERN SECTION OFFICERS AND COMMITTEE CHAIRMEN—L to r: Frank H Cooper, sectional committeeman; John C Cook, publicity chairman; James Hall; Frederick T Lense, chairman, Intersectional Contest Committee; William E Fayssoux, Councilor; William B Amos, treasurer; William B Griffin, chairman; Cecil Ray; Warren E Tiller, secretary; Nesbit Johnston, sectional committeeman; H Gillespie Smith, national vice president; Ed Ravenel; Elwood Barbre; Cal Winkleman Jr, sectional committeeman; T Howard McCamy, Councilor

SOUTHEASTERN SECTION INTERSECTIONAL CONTEST COMMITTEE—Bottom row, l to r: Helen L Richey, Hazel T Stevens, Frederick T Lense, *chairman*, William Postman. Top row, l to r: T Howard McCamy, Cecil B Ray, Leon Tigler, H Gillespie Smith, Carl Blumenstein, and Marvin H Smith

Chairman William B Griffin is shown presiding at the technical session held at Callaway Mills. On left is Leon Tigler, sectional committeeman in charge of the meeting, and Warren E Tiller, secretary. At the right is J M Newton, Clinton Corn Processing Co, who served as guest speaker

AATCC Vice President H Gillespie Smith (left) and Russell Gill look on as Chairman William B Griffin shakes hand of Thomas Hollace, Georgia Tech senior, who was awarded mid-year scholarship by the Southeastern Section



J M Newton, Clinton Corn Processing Co, delivering his address on the subject "Corn—America's Most Versatile Crop"

Activities of the Local Sections———

NEW OFFICERS OF THE PIEDMONT SECTION—Seated: J C King, chairman (left), and Linton C Reynolds, vice chairman. Standing, l to r: R E Rupp, Councilor; C Brown Wright Jr, treasurer; Warren E Rixon, retiring chairman; Richard E Rettew, secretary.

NATIONAL OFFICIALS ATTENDING THE PIEDMONT SECTION'S FALL MEETING—Seated, l to r: Thomas R Smith, past president; George O Linberg; president; Weldon G Helmus, vice president, Central Atlantic Region. Standing, l to r: Walter M Scott, chairman, Publications Committee; Charles A Sylvester, chairman, Technical Committee on Research; Albert E Johnson, chairman, Committee on Corporate Membership; George P Paine, executive secretary; Sidney M Edelstein, chairman, Archives Committee.

Piedmont

THE Piedmont Section held its Fall meeting on Saturday, September 20, 1958, at the Hotel Charlotte, Charlotte, NC, following the meetings of AATCC's Council and National Committees the previous two days.

The afternoon technical session drew an impressive audience to participate in a Symposium on Wash-and-Wear, which was moderated by Victor S Salvin, Celanese Corp of America. Panelists included Albert C Nuessle, Rohm & Haas Co, who spoke on the subject from the viewpoint of the chemical supplier; John C Stass, Burlington Industries, Inc, who discussed "Wash and Wear or Easy Care Testing Methods and Standards"; and Genevieve M Smith, Sears, Roebuck & Co, whose talk was entitled "I Want to Return It Because."

The Section's traditional social hour preceded the evening banquet, at which the following new officers were installed: *Chairman*—J C King, Metro-Atlantic, Inc; *Secretary*—Richard E Rettew, Polymer Southern, Inc; *Vice Chairman*—Linton C Reynolds, Riegel Textile Corp; *Treasurer*—Vincent B Wright Jr, North Carolina Finishing Co.

Speaker of the evening was C S Reed, vice president, Duke Power Co.

Other highlights of the Banquet were the awarding of the 25th Anniversary Tray to Past Chairman George P Feindel, and the Past Chairmen's Plaque to Retiring Chairman Warren E Rixon.

Warren E Rixon (left), retiring chairman, receives Past Chairman's Plaque from Past Chairman C O Stevenson.

George P Feindel (right), technical director, Rock Hill Printing & Finishing Co, Rock Hill, SC, receives 25th Anniversary Tray from retiring Chairman Warren E Rixon.

Metropolitan

THE Metropolitan Section's first meeting of the 1958-59 season, held Friday evening, October 10th at Kohler's Swiss Chalet, Rochelle Park, NJ, attracted 230 members and guests. Chairman Donald E Marnon, Berkshire Color & Chemical Co, presided.

Charles W Dorn, chairman of AATCC's Executive Committee on Research, presented national service awards to the following Metropolitan Section members for their service on various national research committees: William A Holst Jr, John K Sumner, Philip B Roth, Max W Winkler, and P J Wood.

John H Hennessey, chairman of the Nominating Committee, presented the following nominations for Section offices: *Chairman*—John A Komninos, Waldrich Co; *Vice Chairman*—Percy J Fynn, J C Penney Co; *Secretary*—Richard P Monsaert Jr, American Felt Co; *Treasurer*—Richard E Miller, Eastman Chemical Products, Inc; *Councilor*—George S Wham, Good Housekeeping Institute; *Sectional Executive Committeeman*—Donald E Marnon.

Two papers were presented during the technical session. C R Williams, Monsanto Chemical Co, discussed "A Quantitative Measurement of Fabric Appearance: A Practical Evaluation of Wash-and-Wear Characteristics." Fernand Schlaeppi, technical manager, Ciba Co, Inc, discussed "Some New Developments in the Application of Cibacron (Reactive) Dyes."

1958 Outing • Northern New England Section

by Francis K Burr

THE Northern New England Section held its 33rd Annual Outing on Friday, Sept 12th at the Wachusett Country Club, West Boylston, Mass. The gathering was favored by excellent New England fall weather which whetted the appetites of the sports enthusiasts for the wonderful dinner which followed a day of outdoor activities.

Chairman Jim Aronson headed a committee that did an outstanding job of preparing events for the members and their guests. He was ably assisted by David Collins, assistant chairman; Warren Lincoln, golf chairman; Hans Walz, horseshoe pitching chairman; Johnnie Murphy, baseball chairman; Johnnie Signorino, putting chairman; Bill Flanagan, niblick pitching chairman; and John Markgren, the ever-satisfying dining chairman. Hank de Redon was chairman of the Prizes Committee.

A special event of the outing was the award of the Martin Weiner Co trophy, a silver plate, to the wearer of the most unusual printed sports shirt. The competition was strong and several ineligible contestants dazzled the attendants. The winner selected was Tom Anderson.

Another special event was the presentation of a national service award to retiring Chairman Wally Birdsall of the Committee on Resistance to Insect Pests by National President George Linberg.

The baseball game was umpired by Azel Mack (who was later presented a seeing-eye dog). Don Thomas, captain of the "A" team led his charges to a 9-5 victory over Bob Lyle's "B" team. Vic Tessier pulled off a grandstand catch in left field to scotch a rally by the "B's," while George Cordeau's towering homer was a bright moment for the losers. Walter Larkin was the winning pitcher; Bill Kiefer, the loser.

Among members, the following were awarded prizes for their golf performances: *0-13 handicap*—1st low gross, Stan Fagan; 2nd, Walt Wood; 1st low net, John Ormiston. *14-26 handicap*—1st low gross, Andy McNulty; 2nd, John Dalton; 1st low net, Basil Nicholson; 2nd, George McDonald. *27-up handicap*—1st low gross, Saf Sweatt; 2nd, Hank de Redon; 1st

AATCC President George O Linberg (left) presents Wally Birdsall with national service award

Edward W Bell (right), NNE Section chairman, presents the Martin Weiner Award to Tom Anderson

NNE 1958 OUTING COMMITTEE—Front row, l to r: Hank de Redon, Jim Aronson, chairman, John Markgren, Hans Walz. Back row, l to r: Bill Flanagan, Johnny Signorino, Warren Lincoln, Ed Bell, Phil Durfee, Johnnie Murphy, David Collins

Stan Fagan (left), winner of member's low gross in golf; Hank de Redon, chairman, prizes

L to r: Joe McNeill, winner of the "Snake Killer Award"; David Collins, assistant outing chairman; Hank de Redon, chairman, prizes

low net, John Adomowitz; 2nd, Bill Flanagan.

Among guests, the following were awarded prize for their golf performances: 1st low gross, V L Wilkinson; 2nd, George Cordeau; 1st low net R D Herrick; 2nd, Charles Herrick; 3rd, J Hunter.

Other prize winners of various golfing events were as follows: nearest to the pin, Warren Dewing; 2nd, Tom Anderson; longest drive, Leo Gendron; 2nd, M G Hopkins; putting, Eric Schlagenhaufen; 2nd, Dick Herrick; pitching, Ed Desmond. Joe MacNeill won the famed "Snake Killer Award" for high gross.

In horseshoe pitching, Don Thomas won the singles event, with Ernie Tabor second. The team of Bob Strickland and Ben Gesmer won the doubles event.

AATCC members in Charlotte, NC, for National Committee and Council meetings in September took advantage of an invitation by Celanese Corp of America to visit the firm's Textile Division headquarters.

The group was assembled and driven to the Charlotte Office Building, where they were addressed by Reiner G Stoll, director of applications and product development for the Division. Following Dr Stoll's talk, which outlined the program underway at Charlotte, the group was divided into smaller units and conducted through the Charlotte facilities, including the Dyeing and Finishing Laboratory, the Process Development Laboratory, Evaluation Laboratory, the Staple Laboratory, and the Weaving Laboratory.

More than 200 chemists, physicists, engineers, textile technologists, technicians, mechanics and operators comprise the staff of the Charlotte Development Laboratories.

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

58-19

Education: *BS*, textile chemistry; Student Award 1950.

Experience: Sales service and technical demonstrator; research and development; sales promotion and advertising.

Position desired: Technical sales, sales service or research and development.

Location: Mid-Atlantic states, Delaware Valley preferred.

Age: 38, married, two dependents; references.

58-20

Education: BS, textile engineering, chemistry and dyeing.

Experience: Technical sales, sales development, laboratory development, sales liaison; chemical specialties; supervisory experience.

Position desired: Technical sales & development; development of new finishes for mill or fiber manufacturer or textile specialty manufacturer.

Location: No preference.

Age: 37; married, two dependents.

58-21

Education: BS, textile chemistry, Lowell Technological Inst.

Experience: Research lab technician, dye lab technician, laboratory chemist and general foreman.

Position desired: Dyehouse superintendent or assistant, technical service representative.

Location: Southeast desired.

Age: 40; married, four dependents; references.

COLOUR INDEX IS COMPLETE. ORDER NOW!

AATCC Calender

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTEES

Jan 28-30 (Hotel Statler, New York, NY
Jan 28—Research Committees
Jan 29—Council Committees. TCR, ECR
Jan 30 (AM)—Council Meeting
May 1959 (Montreal, Canada)

NATIONAL CONVENTIONS

Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

DELAWARE VALLEY SECTION

Dec 5

HUDSON-MOHAWK SECTION

Nov 14 (Chelsea House, Tribes Hill, NY); Jan 16 (Jack's Restaurant, Albany, NY); Mar 27 (Chelsea House, Tribes Hill, NY); May 15 (Ladies night, Albany area); June 26 (Annual outing—Antlers Country Club, Tribes Hill, NY)

NIAGARA FRONTIER SECTION

Dec 5 (Buffalo, NY); Feb 20 (Niagara Falls, Ont); April 4 (Hamilton, Ont—joint meeting with CATCC)

NORTHERN NEW ENGLAND SECTION

Dec 5 (Hotel Vendome, Boston, Mass); Jan 16 (Colonial Club, Lynnfield, Mass)

PIEDMONT SECTION

Jan 24 (Poinsett Hotel, Greenville, SC); April 10-11 (Robert E Lee Hotel, Winston-Salem, NC); June 5-7 (Outing—Grove Park Inn, Asheville, NC); Sept 25-26 (Barringer Hotel, Charlotte, NC)

RHODE ISLAND SECTION

Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence)

SOUTHEASTERN SECTION

Dec 6 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Dec 5 (Rapp's Restaurant, Shelton, Conn)

CORRECTION

YOUR attention is called to a printing error on page P739 of the October 20th issue. In the box at the bottom of the page, the first paragraph was garbled by the printer. It should read as follows:

Trustees of the Charles H Stone Scholarship Fund, Piedmont Section, AATCC, have announced a grant of $250 to Frederick M Warlick Jr, a student at North Carolina State College.

ELECTED TO MEMBERSHIP

September 11, 1958

SENIOR

Casimer Bieleski, Hubert A Daners, Ollie O Eubanks, Mario L Ferrari, Robert C Gober, Dorel Marian, Hugh D Mason, Marshall V Otis, Andrew J Paros, Robert Pereles, Stephen Raymond, Robert Reinhardt, Marvin Watts, William T White, Charles Q Wright

ASSOCIATE

Sister Mary Verda, Sondol E Werner

STUDENT

Mohammed F Dossa

September 25, 1958

SENIOR

Grady C Norris, Zeddie L Collins, Frank J Kiluk, Donald S Morton, Armand A Zaleon

ASSOCIATE

R Whit Hamrick, James W Root

JUNIOR

Wayne Barringer

October 8, 1958

SENIOR

Thomas J Cronin Jr, James E Garrett, Robert C Hargreaves, William J Maher Jr, Werner F Schulz, George J Western, Arthur Haavie

ASSOCIATE

Richard E McSweeney, Martha J Ulrich

COLOUR INDEX AMENDMENTS AND ADDITIONS

IN conformity with the policy stated in the preamble to the Second Edition of the *Colour Index*, lists of amendments and additions will be published in the *American Dyestuff Reporter* and in the *Journal of the Society of Dyers and Colourists*.

The first list, including alterations brought to the attention of the editors since Volume 4 went to press, appears below. Subsequent lists may be expected quarterly beginning in January.

It is intended that the lists, printed on one side of the page only, will be available.

Further information will be given with the next list.

Page		*Colour Index No.*	
1297		CI Acid Blue 154	
	delete	Fenapal Blue 2R	G
	delete	Palatine Fast Blue RRNA-CF	G
1299		CI Acid Blue 158 or 158A	
	for	Chromacyl Wool Blue GG	DuP
	read	Chromacyl Blue GG	DuP
2629		CI Azoic Yellow 1	
	add	Naphtazogene Yellow J	Fran
2630		CI Azoic Yellow 4	
	add	Naphtazol Direct Yellow 2J	Fran
2631		CI Azoic Yellow 7	
	add	Naphtazol Direct Yellow J	Fran
2633	*delete*	CI Azoic Yellow 14, 15, and 16	
2635		CI Azoic Orange 2	
	add	Naphtazogene Orange J	Fran
2638	*delete*	CI Azoic Orange 16	
2641		CI Azoic Red 1	
	add	Naphtazogene Scarlet R	Fran
2642		CI Azoic Red 6	
	add	Naphtazogene Red J	Fran
2645		CI Azoic Red 17	
	add	Naphtazol Direct Scarlet R	Fran
2650	*delete*	CI Azoic Red 39	
2651	*delete*	CI Azoic Red 42 and 43	
2662		CI Azoic Blue 8	
	add	Naphtazol Direct Blue B	Fran
2664	*delete*	CI Azoic Blue 15	
2858		CI Solvent Red 49	
	delete	D&C Red No. 19	CCC, KO, NAC

8th ADR Award———

(*concluded from page P757*)

textile chemical research at Onyx Oil and Chemical Co, Jersey City, NJ.

Judges for this year's contest, appointed by the Publications Committee, were: Richard B Stehle, Allegheny Dye Works, *chairman;* Hector C Borghetty, formerly with Rohm & Haas Co, and now with General Aniline & Film Corp; and Carl Z Draves, General Dyestuff Co.

The Award was endowed by the Howes Publishing Co, Inc, as a memorial to Alfred P Howes, founder of the *American Dyestuff Reporter*. Its purpose is to encourage the presentation of the best possible papers before local and national meetings of the Association.

The Award, $200 annually, is presented to the author or authors of the paper considered best in the opinion of the judges. Any technical paper presented before a local or national meeting of the AATCC and published in the *Proceedings* is eligible with the following exceptions: Intersectional Contest papers, papers by employees of the AATCC, reports of work substantially subsidized by AATCC, or reports of research committees. It is a condition of eligibility that the paper have its first publication in the *Proceedings*. Papers published in the *Proceedings* from July 1st of one year to June 30th of the next year are considered in each judging period.

Details of previous ADR Award winners appeared on page P713 of the October 20th (AATCC Convention) issue of *American Dyestuff Reporter*.

IMPORTANT NOTICE

To all manufacturers of Textile Chemical Specialties:

The American Association of Textile Chemists and Colorists is now collecting material for the 1959 Edition of the Technical Manual (formerly Technical Manual and Year Book), and solicits your cooperation.

Please note that the list of Textile Chemical Specialties will be completely revised and brought up to date as in past years. All manufacturers and importers of textile chemical specialty products are therefore invited to submit data for the 1959 edition, covering the following items only:

New products and data not previously listed
Correction of errors
Deletion of obsolete products (including deletions from the Index, pages 319-341, 1958 edition, as well as Alphabetical List).

Cards should be filled out strictly in accordance with the directions accompanying this notice, and following the style of presentation employed in earlier editions. To meet editorial schedules, all cards must be received by the undersigned before December 15, 1958.

WILLIAM D APPEL, Editor, Technical Manual
9101 Jones Mill Road, Chevy Chase 15, Maryland

DIRECTIONS FOR FILLING OUT CARDS

In the compilation of this list of American sources of textile chemical specialties, products are selected primarily for their specific usefulness in textile processing, with the idea of presenting such information for the benefit of the textile chemist and colorist. However, because some textile chemicals, such as surface-active agents, are employed in other industries, nontextile uses are permitted to be indicated.

The reader should bear in mind that information from firms concerning uses and composition is repeated without investigation and thus cannot be vouched for by the AATCC. On the other hand, because listings are made without charge for the benefit of our membership, we reserve the right to edit carefully all data received, and especially to revise the list of "various uses" where necessary to conserve space.

Information for new products should be tabulated on cards as described on the reverse of this page. Where it is desired to make corrections in old entries in either the Index or the Alphabetical list, or to make deletions of old entries for withdrawn products from both of these, new cards should be prepared in the same manner, appropriately marked for correction or deletion, as described in the directions. Do not prepare cards for products already properly indexed and listed. Please note that we do not furnish printed forms; ordinary white ruled 3" x 5" index cards should be used.

Full instructions for preparing the cards are given on the reverse side of this page and examples of cards properly filled out are shown. In making out the cards it is necessary that you follow the instructions carefully; otherwise they may be returned for improvement. In particular, please avoid the use of capitals except for necessary initial letters; be sure to report all products which have been discontinued; and please see that the "Chemical Nature" is properly recorded. We do not ask you to reveal secret information, but such descriptions as "amine compound" or "organic salt" are not considered adequate.

I. KEY

ABCDE

ABCDE Chemical Co.

24 South Main St.

Deep River, Conn.

(a) On first line: firm abbreviation, limited to not over five letters.

(b) On third line: firm name

(c) On fourth and fifth lines: firm address

NOTE: Only one Key Card is necessary from each manufacturer

II. INDEX

Bleaching Agents

Ableachor ABCDE

New index Entry

(a) On first line: enter one of the headings taken from the Index in previous editions, indicating an important use for the product being reported. If it has several uses, make out a separate card for each.

(b) On third line, toward left: list the name of the product (only one) without any descriptive letters or numbers.

(c) On third line, near right margin: list the abbreviation of the firm name, taken from the key.

(d) On bottom line: indicate whether the card is a New, Corrected, or Deleted Index Entry.

III. ALPHABETICAL LIST

ABCDE

Ableachor* CWS

Bleaching of all fibers

H_2O_2

New List Entry

(a) On first line: abbreviation of firm name.

(b) On third line: complete proprietary name of product, with descriptive letters or numbers; if name of product is a registered trade-mark, indicate the fact by an asterisk following the registered part of the name.

(c) On fifth line: various uses, limited to 20 words.

(d) On eighth line: chemical nature, adequately given.

(e) On tenth line: patent number, if product is patented.

(f) On bottom line: indicate whether the card is a New, Corrected, or Deleted List Entry.

Abstracts

Principles of Applying Disperse Dyes

Finlayson, D and Olpin, H C, *Dyer* **119**, 835-6, June 6, 1958

The authors point out that the disperse dyes are nonelectrolytes, and may be regarded as organic compounds which are soluble in organic solvents and just happen to possess the important property, from the point of view of the dyer, of absorbing in the visible spectrum. There are three chemical groups of these dyes: Azo, Anthraquinone and Nitrodiphenylamine.

Disperse dyes are applied from a suspension in an aqueous dyebath containing a dispersing agent, and are not normally regarded as being soluble in water. This, however, is not strictly true, the authors state, since many of them are appreciably water-soluble, and in fact they must be sufficiently soluble to pass through the aqueous phase.

The system at the start of the dyeing operation consists of three phases —the dyebath, which is an aqueous solution of the disperse dye; the fiber; and disperse dye particles. When dyeing is completed, however, the disperse dye phase will have disappeared (unless there is dye in excess of that necessary to saturate both fiber and dyebath), and the system now consists of two phases in equilibrium, a solution of dye in the fiber and a solution of dye in the dyebath.

The authors discuss the effect of increase of temperature in the dyebath beyond 100°C on the rate of dyeing, particularly on such fibers as Terylene, Tricel and the acrylics. Another benefit of high temperatures is an increase in the solubility of the dye in the fiber. Consequently it is essential to dye at the highest possible temperature.

The rates of diffusion of a disperse dye into Terylene and into Tricel are compared.

Heat-shaped Dynel Fabrics

Snyder, A L, *Modern Textiles* **39**, 33-4, June, 1958

Important new design and engineering improvements in the production of radios, furniture, clothing and many industrial parts are now possible through use of special heat-shaped fabrics of Dynel acrylic fiber, produced by Union Carbide Chemicals Co.

This development is said to make economically possible many new uses for textile fabrics. It utilizes the thermal pliability of Dynel to achieve molded, embossed, or stiffened shapes by a simple heating, shaping and cooling process. The same processes used for molding plastic sheets are readily adaptable to shaping Dynel fabrics.

The shaping process in its simplest form is done by forcing a cold mold into a piece of 100% Dynel fabric that is clamped on the outer periphery and heating to 320°F. The fabric is held in shape while being permitted to cool. The clamped area can then be trimmed to size. The shaped fabric will retain its form until reheated to nearly the temperature of shaping.

The author states that best results are obtained with fabrics that already have been dyed or boiled off, rather than with greige goods. Similarly, knit goods can be heat-shaped best if finished beforehand.

The stiffness of a shaped Dynel fabric is dependent on the temperature, time of heating, and tension during the heating operation. The greater any of these factors, the stiffer the cooled fabric will be. Use of lower temperatures and low tension will produce molded Dynel fabrics as soft as before shaping.

The author lists a number of uses that have been developed for shaped Dynel fabrics, including deep-pile fabrics embossed to give the effect of a curled hair surface for women's coats; flat fabrics "dimpled" or ribbed to provide air spaces for heat insulation in special clothing; and fabrics stiffened for cap visor linings, rain-resistant summer hats, etc.

Spun-dyed Fibers: Their Properties and Uses

Wilcock, C C, *Dyer* **119**, 541-2, April 11, 1958

The author states that large quantities of spun-dyed fibers are now being used in England and the consumption is steadily increasing.

Spun-dyed viscose and acetate, both continuous filament and staple, have the greatest production at present. Pigments are used for the coloring matter. In the U S, spun-dyed black nylon and Orlon are said to be available, as well as a few shades of Dynel and a wide range of Saran, used for car upholstery.

The pigments used are carbon black, iron oxides, nitro, anthraquinone and indigoid compounds and the very important phthalocyanines. Suitable pigments must be finely divided and dispersed so as not to block the spinning jets; must not catalyze degradation of the fiber by light; must have high tinctorial value; must be stable to acids and alkalis, and in the case of synthetic fibers, to heat, and must have satisfactory fastness for end-use requirements.

It is emphasized that the dyeing and other chemical properties of the spun-dyed fibers are the same as those of the white fibers.

Spun-dyed fibers are used mainly for their fastness properties. They permit the fabric manufacturer to reproduce shades exactly, lot after lot, perfectly even from side to side and end to end. In most cases, superior fastness to light and rubbing is obtained by their use, and the fastness to washing and drycleaning is generally extremely good. The author adds, however, that spun-dyed fibers will always have to be supplemented by fibers dyed by normal methods.

Chemical Modification of Cotton: Progress and Current Status

Fisher, C H and Perkerson, F S, *Textile Research J* **28**, 769-78, Sept, 1958

The authors state that more progress has been made in cotton research in the last decade or so than in the past several centuries.

The successful use of chemicals to impart durable, significant changes to cotton is a development of this century. Because of the success of chemistry in recent years in transforming cotton into valuable new products, many new cotton products of diverse nature are now commercially available.

In this paper, "chemical modification" includes any chemical treatment of cotton that will cause durable, substantial changes in properties.

Among the earlier examples of modified cotton referred to briefly by the authors are acetylated cotton; immunized cotton (resisting dyes); wrinkle-proof and dimensionally stable cotton fabrics (treatment with urea-formaldehyde); and soluble cotton gauze and yarn.

Since 1950 a number of new modified cotton products have been developed, including the following:

Cyanoethylated cotton, introduced by the Institute of Textile Technology, which has improved resistance to rot and heat and enhanced affinity for some dyes.

Durable flame-resistant cotton, produced by treatment with a combination of APO and THPC (organic phosphorus compounds), which withstands repeated laundering.

Wash-wear cotton fabrics with durable creases and complete launderability, produced by application

of certain resins (eg, dimethylol ethyleneurea).

Cotton fabrics that shed both oil and water, produced by treatment with certain fluorochemicals.

Cotton treated with lead chromate, which is weather-resistant and is used as shade cloth for tobacco plants.

Estimated costs of producing some of these modified cottons are included.

It is stated that all the chemically modified cottons thus far studied have been amenable to dyeing with some types of dye; hence dyeing seems to present no serious problem.

The authors describe a number of projects now under way in various laboratories, involving still further modification of the cotton fiber. They point out that one of the barriers to making new and useful cotton products by chemical treatment is the excessive stiffness and other undesirable properties resulting from some of these treatments. It has been found that cross-linking the cellulose prior to chemical modification prevents or minimizes these undesirable effects.

Seventy-three references to the literature are cited.

Titanium Compounds in Reproofing (Waterproofing Textiles)

Sidlow, R, *Dyer* 120, 301-4, August 29, 1958

One of the most popular waterproofing processes for textiles comprises a paraffin wax emulsion plus an aluminum salt (eg, basic aluminum formate). When a fabric so treated is drycleaned, the proofing agent is removed by the solvent, and a reproofing is necessary. Solutions of wax and aluminum stearate are used for this purpose, but the degree of proofing is poor, according to the author.

The use of solvent-type waterproofing processes based on titanium compounds was first disclosed by Du Pont. A composition of a solvent solution of a titanium ester plus paraffin wax was recommended. The fabric was immersed in this solution, extracted and dried. During drying the titanium compound was hydrolyzed to an insoluble product. Premature hydrolysis of the ester was prevented by addition of certain glycols (eg, hexylene glycol).

The author surveys a large number of other similar proofing treatments which have been investigated, in which various titanium compounds were used. These were all tested for stability to hydrolysis, using nonyl titanate as the yardstick. The most promising ones were further subjected to the spray test, the hydrostatic head test, and the Bundesmann absorption and penetration tests. A commercial proofing compound (nontitanate type) was included for comparison. The textiles used for these tests were cotton, rayon and wool gabardines. The results of the trials are tabulated and discussed.

The author points out that these tests demonstrate that extreme stability of a titanium compound interferes with its water repellency.

New Aluminum Complex Water Repellent

Anon, *Dyer* 119, 104, Jan 17, 1958

The Grasselli Chemicals Dept of Du Pont has introduced a water-dispersible complex of aluminum and myristic acid, primarily as a water-repellent and stain-resistant finish for textiles and other materials. This product, called "Aluminum Complex 101", is applied in conventional padding and drying equipment. It is said to develop water repellency and stain resistance on a wide variety of textile materials, including wool, cotton, rayon and other synthetic fibers, and to be nondiscoloring.

Aluminum Complex 101 is supplied as a solution in isopropanol. Instructions for its application are given. When diluted with water it has a pH of about 4.0. According to the makers, a spray rating of 80-100 can be obtained on wool, nylon, Dacron, Orlon, and wool/synthetic blends. On wool, the water repellency provided has good permanency toward drycleaning and some permanency to mild soap washes. It has a lower degree of permanency to cleaning processes on the noncellulosic synthetic fibers. On cellulosic fabrics it is less effective, and spray ratings do not exceed 70-80.

The new water repellent is said to reduce static build-up by a factor of 3 or 4 on many nylon and rayon-nylon fabrics.

Printing the Man-made Fibers

Baumann, H P, *Textile Inds* 122, 75-80, August, 1958

Printing with pigments has increased. Advances in emulsion techniques and inventions in the range of the pigments themselves have added to the flexibility and diversification of their use.

A pigment, to be suitable for printing, must be of good tinctorial value; it must be bright, of pleasing shade, fast to light, washing, acids and alkalis; must not sublime under temperatures of curing or ironing; and must be insoluble in drycleaning solvents.

The author compares the advantages and disadvantages of the two main classes of pigment emulsions: the water-in-oil system, and the oil-in-water system.

Pigment emulsions can be applied to all fibers, but their poor fastness to crocking makes them undesirable for some usages (eg, chair covers).

The conventional method of applying vat dyes is described in detail, with particular mention of "flash aging", which is gaining in popularity. Printed on nylon, the vat dyes usually have poorer lightfastness than on cellulosic fibers. The author recommends shallow engravings for nylon printing.

Vat dyes may also be applied by an emulsion process, which is described.

Acetate fabrics can be readily printed with disperse dyes, thickened with gum. The prints are dried and steamed for 30 to 60 minutes with low-pressure steam, or aged twice. The choice of suitable dyes depends on their dispersibility and their fastness to sublimation.

Basic and acid dyes have little affinity for acetate, but can be printed with the aid of a swelling agent.

The author gives directions for discharge printing of acetate; several different methods are proposed. He states, however, that the number of dischargeable dyes on this fiber is limited. Color discharges with vat dyes are also discussed.

Acrilan can be satisfactorily printed with disperse, basic and acid dyes. Acrilan/wool blends are preferably printed with the basics. Typical printing formulas are included.

Orlon has been printed with disperse dyes in a manner similar to acetate. The prints are steamed for 1½ hours with pressure. Brighter and stronger colors are obtained with the cationic (basic) dyes (eg, Sevrons).

Dacron presents a problem, since so few dyes will fix well on it. Selected disperse dyes, fast to sublimation, can be used. Prints must be steamed under 10-15 lbs pressure.

Nylon may be printed with disperse, vat, and selected direct, basic, acid, chrome and premetallized dyes. Disperse dyes are readily applied. Premetallized dyes have good affinity for nylon, and many acid dyes may be printed in full and medium shades. Discharge printing of this fiber suffers from several major difficulties which are described.

Arnel and Darvan fibers may be printed with disperse dyes.

In the steaming processes previously mentioned, where pressure is advocated, sublimation of colors must be guarded against by suitable interlayers of grey cloth or paper.

News of the Trade

Monsanto Three-Dimensional Wash 'n Wear Standards Kit

Monsanto Offering W&W Test Patterns Kit

Three-dimensional standards for rating the wash-and-wear characteristics of resin-finished fabrics have been developed by Monsanto Chemical Company's Plastics Division, Springfield, Mass.

Researchers in the division's textile laboratory have assembled five test patterns in a kit now being offered to textile finishers, garment manufacturers and testing laboratories. Incrementally covering the established range of wash-and-wear performance, the patterns constitute a handy scale for evaluating test specimens by fixed procedures.

Fabric samples are washed and dried according to controlled conditions specified by the American Association of Textile Chemists and Colorists (Proposed Tentative Test Method 88-1958). Their wrinkle patterns then are compared visually with those of the three-dimensional standards. Each specimen is assigned the rating of the standard it matches.

S F Sylvester, the division's manager of textile resin sales, said the new standards represent a substantial improvement over the two-dimensional standards now in general use. (A set of photographic reproductions introduced by Monsanto early last year since has become a popular criterion for rating wash-and-wear performance.)

"To protect itself and its customers, the textile industry needs a system for indexing wash-and-wear performance," Sylvester said. "Monsanto's new rating method is a further step in that direction.

"Although the method is dependent upon subjective judgments, experience to date has demonstrated that results are highly reproducible."

Test panels are vacuum-formed from high impact styrene sheet. Visually, they are difficult to distinguish from the actual 13-inch square fabric samples from which they were made.

Each kit is furnished with instructions and is packaged in a handy carrying case. Monsanto is offering the kit for $20. Inquiries may be directed to Department WW, Monsanto Chemical Company, Springfield, Mass.

Norton to Address CATCC Section

Joseph E Norton, director of research & development, Atlas Electric Devices Co, Chicago, Ill, will discuss the subject "Various Aspects of Lightfastness Testing Methods and Results" at the November 21st meeting of the Ontario Section, Canadian Association of Textile Colourists and Chemists.

Berkshire Color & Chemical Co Expands Plant

Berkshire Color and Chemical Co, Inc reports the near completion of its manufacturing, warehousing and laboratory expansion program at the Reading, Pa plant. These additional facilities will be housed mainly in a new 16,000 sq ft two-story building adjoining the southern end of the firm's existing plant.

One of the major purposes of this program is to bring about a consolidation of the Company's manufacturing operations. It is planned that all blending, pulverizing and standardizing operations currently carried out at the Delawanna, NJ plant will be transferred to the Reading plant.

Two new laboratories are being equipped, one to handle dyestuff standardization and customer service, the other to handle plant control and quality problems.

The new building incorporates a large warehouse for storage of crude and finished color. This warehouse is not intended to replace existing facilities but is designed to reinforce and supplement their stocks.

Columbia-Southern Announces New Bleaching Technique

Substantial reductions in textile bleaching costs are promised through a new technique under development by Columbia-Southern Chemical Corporation's market research and development department. Hydrogen peroxide and sodium hypochlorite reportedly have been recombined in a practical manner to reduce bleaching costs through reduction of chemicals used.

Elimination of desizing operations on a large portion of goods processed is said to be a definite possibility. Goods treated by this technique contain no residual chlorine, according to the company.

Laboratory investigations point out the economic advantages of this technique. The company states that pilot-scale performance confirms preliminary results. Simplicity of operation is said to be such that immediate conversion to production may be made without additional equipment. Goods are uniformly bleached to high brightness with improved absorbency and hand as well as good dyeability and strength, it is claimed.

Synthron, Crest Merge

The merger of Crest Chemical Corp of Newark, NJ, and Synthron, Inc of Ashton, RI was announced recently by the respective presidents, B Robert Schwartz and Robert Zametkin.

The Newark Plant manufactures surfactants, sequestering agents, softeners and dye-fixatives for the textile trade and will function as an independent division of the combined operation. Its facilities and personnel are being increased.

Synthron, Inc will continue to manufacture synthetic resins, durable finishes, detergents and industrial chemicals at the Ashton plant. Warehouse stocks will be maintained in Rhode Island, Newark, and Charlotte, NC.

It was stated by the principals that a new Southern plant, research and customer service laboratories are in the planning stage. It was announced that, at the Southern location, the combined lines of both companies will be manufactured in a plant of advanced design.

Crest Chemical Corp was established in Newark by Dr Schwartz and M W Grayson in 1956. Prior to the forming of Crest, Dr Schwartz was technical director of Hart Products Corp. Mr Grayson previously served as sales manager for the Paulden Laboratories.

In 1946, Synthron, Inc was organized by Mr Zametkin, who previously had been associated with Quaker Chemical Products Corp, Conshohocken, Pa, from 1939 to 1946, and earlier with the Pilgrim Piece Dye Works, Inc, New York.

Hunter to Build New Plant for Southern Subsidiary

The James Hunter Machine Co, North Adams, Mass, manufacturers of textile wet finishing, drying and garnetting equipment, has announced its intention to build a new plant for its subsidiary company, James Hunter, Inc, of Greenville, SC.

The Company officials stated that land had been purchased on the old Route 276, Laurens Road, approximately eight miles south of Greenville. A 20-acre plot is now being graded, and a 35,000 square foot building contract has been awarded.

The completion date is scheduled within six months, and James Hunter, Inc, will move from its present quarters at 745 Lowndes Hill Road, Greenville, to the new location.

The parent plant will continue to manufacture its complete line at its main plant in North Adams, Mass.

Chas S Tanner Co plant—Greenville, SC

Tanner Opens New Southern Plant

The Chas S Tanner Co, Providence, RI, has opened a new Southern plant in Greenville, SC, on the Furman Hall Road, just off 291 By-Pass, near Stone Mfg Co.

The new plant consists of approximately 10,000 square feet, providing space for both warehouse and manufacturing facilities to service the textile finishing field.

Celanese to Double Acetic Acid Capacity

Celanese Corporation of America has announced plans to double the capacity of its acetic acid plant at Pampa, Tex. Work on the multi-million dollar expansion is scheduled to begin this year and to be completed by late 1959.

Richard W KixMiller, Celanese vice president and general manager of the company's Chemical Division, said addition of the new facilities will enable the Pampa plant to produce 240 million pounds a year, or 15% of the nation's total requirements for acetic acid. Combined capacities of the Celanese plants at Pampa and Bishop, also in Texas, will give the company more than one-quarter of the nation's acetic acid capacity, it is reported.

The acetic acid unit is the heart of the Celanese petrochemical complex at Pampa. By a unique process developed at the company's laboratories in Clarkwood, Tex, hydrocarbons are partially oxidized under high pressure to make acetic acid and small amounts of other organics. Acetic acid is used by the Celanese Textile Division, is sold to outside customers, and is reacted further in chemical processes at Pampa to produce acrylate esters, acetic anhydride and vinyl acetate. These products, in turn, are sold to outside customers, consumed by other divisions of the company, and further upgraded by Celanese into fibers, industrial chemicals, and plastics.

The additional acetic acid also will be available for increasing output of two relatively new Celanese products—trimethylolpropane and acrylate esters.

First Participant in Eastman's Plan for Specification Dyeing

First to announce its participation in Eastman Chemical Products' new Plan for Specification Dyeing is Philip Kramer & Bros, 333 Seventh Avenue, New York, 40-year-old converter of lining fabrics for the fur trade.

Each lot of Kramer's piece-dyed acetate fabrics will be tested by Eastman for resistance to three AATCC gas cycles before shipment to manufacturers. According to Joseph Shinsky, spokesman for Kramer, this high degree of gasfastness will enable his firm to offer piece-dyed acetate lining fabrics which will be free from fading due to atmospheric fumes well beyond the normally anticipated life of the fur garment in which they are used.

In making this statement Shinsky pointed out that three gas cycles are considered satisfactory for fabrics used in the drapery trade where conditions leading to gas fading are even more severe than for garment linings.

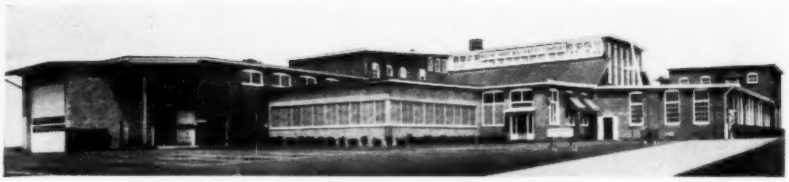
As each lot of Kramer's fabrics is processed, a swatch is sent to Eastman's Lodi, N J, laboratories where the necessary tests are immediately performed. The results are forwarded to Kramer and become evidence for Kramer and those using its fabrics that each lot possesses the specified fastness characteristics.

"New York is *The* Textile Town"

Over thirty leading textile companies are cooperating in a show called "New York Is *The* Textile Town," which will open on November 17 at Union Dime Savings Bank, Avenue of the Americas at 40th St.

The exhibit, designed to dramatize the uses of fabric for industry, the home, and apparel, will be open to the public through January 16 Mondays through Fridays from 9:00 to 3:00, with additional hours on Thursdays until 6:30.

The fabrics to be displayed were selected by a committee from swatches submitted by the participating companies.



Mount Hope Machinery Co plant at Taunton, Mass

Enlarged Plant of Mount Hope Machinery Co in Full Operation

A large new addition to the plant of Mount Hope Machinery Co in Taunton, Mass, is now in full operation. According to J D Robertson, president, "this new addition incorporates the most advanced ideas of modern plant architecture together with increased personnel comfort and efficient working conditions—year-round air conditioning and a new system of shadowless, indirect lighting. It will greatly increase Mount Hope's shipping facilities, house an enlarged Engineering Department and provide much needed additional general office space."

Mount Hope was founded in 1941. At present, the company employs one hundred and fifty people and looks forward to further expansion in the future with new developments in machinery already under consideration.

Ciba's Plastic Div Now Ciba Products Corp

Effective October 1, the Plastics Division of Ciba Co Inc, 627 Greenwich St, New York, NY, became merged with its manufacturing affiliate, Ciba Products Corp.

Henceforth, Ciba Products Corp will be the headquarters for all Ciba management, sales and technical services personnel for Araldite epoxy resins. The company will continue to make its headquarters in Kimberton, Pa, until new research and production facilities are completed in Toms River, NJ, and its administrative and sales offices are transferred to new quarters in Fair Lawn, NJ.

According to Harry B Marshall, president, Ciba Products Corp will possess a streamlined, self-contained enlarged operation from the raw materials through to basic epoxy resins. This will be sufficient to meet the present demands for epoxy resins and be capable of meeting the constantly increasing requirements for these products by industries of the Western Hemisphere.

Dr Marshall stated that the board of directors of the new corporation would consist of: Robert Kaeppeli, chairman; H B Marshall, president; D B Dyche, treasurer; T F D Haines; C E Hutz and D M Joseph.

Century Chemical Formed

The formation of a new chemical manufacturing concern, the Century Chemical Corp, has been announced by Theodore S Hodgins and John J Levenson Jr. The corporation will have offices in the Lincoln Building at 60 East 42nd Street, New York, NY, and will manufacture chemicals both in the United States and abroad.

Mr Hodgins will serve as president of the new corporation; Mr Levenson, as executive vice president and treasurer. David T McGovern of the law firm, Shearman & Sterling & Wright, will be secretary.

More details of its entry into the chemical industry will be made known by Century Chemical Corp around the first of the year.

NEW CARBOPOL HOME——Pipes carrying raw materials feed into B F Goodrich Chemical Co's new $3-million plant at Calvert City, Ky, for the production of Carbopol, a versatile thickening, suspending, dispersing and emulsifying agent which has a variety of applications, including those in the textile field.

The plant, which began operations in September, has an immediate capacity of 70,000 pounds a month. It is designed so that capacity can be doubled and eventually quadrupled as demand for the product increases.

Carbonol, a water-soluble polymer, is being volume-produced as a fluffy white powder, which is nontoxic and relatively unaffected by temperature and aging.

Of chief interest to the textile processor is the product's application in textile printing.

Arnold, Hoffman Dramatizes "The Procion Influence"

The fashion influence of bright fabric shades made possible by the new fiber-reactive dyestuffs was forecast for an audience of stylists and converters by Arnold, Hoffman & Company, Inc at a presentation staged Thursday, September 25th, at The Hotel Roosevelt, New York.

Using slides to illustrate an "ultra-simple dyeing theory," the company's technical service manager, Raymond Thornton, demonstrated an outstanding characteristic of the company's Procion dyestuffs in that they form an actual chemical link with the fibers to which they are applicable.

Frances van Hall, color counselor and fashion coordinator, praised the unique combination of practical fastness and brilliancy of shades achieved with Procion dyestuffs. Predicting extensive use of the new dyestuffs "whether the quality sought is for high fashion or for rugged everyday durability," Miss van Hall illustrated her talk with a fashion show of models wearing garments cut from Procion-dyed and printed fabrics.

Exhibits included elaborately staged settings of garments and fabrics supplied by various mills and fashion houses now using Procion dyes.

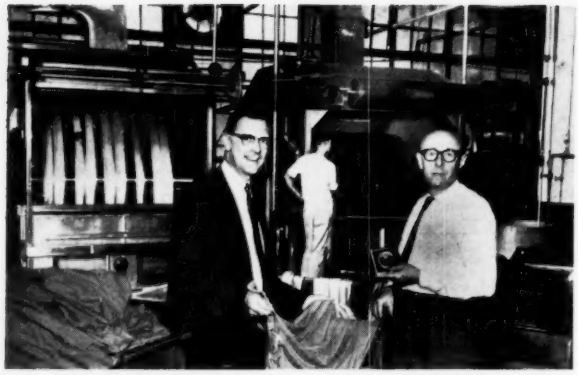
Representing Arnold, Hoffman at their presentation of "The Procion Influence," in addition to Miss van Hall and Mr Thornton, were the company's President W C Cobb; E R Herbertson, commercial vice president; Donald J Eccleston and Leonard G Tubbs, of the sales staff; Kenneth W Bean, manager of advertising and publicity; and Sheldon D Spencer, advertising and public relations counsel.

Atlantic Refining Opens West Coast Chemicals Sales Office

The opening of a new West Coast chemicals sales office in Los Angeles has been announced by The Atlantic Refining Company. The new branch establishes the first direct marketing of Atlantic petrochemicals to Pacific Coast Industry. Warehouse facilities for a wide range of the firm's petrochemical products are located in Los Angeles, San Francisco, and Portland.

W E Smith has been appointed West Coast sales engineer. He has served with the Company's chemicals division in Charlotte, NC, since 1953.

The firm's new office is located at 4814 Loma Vista Avenue.



Joseph Bailis (r), president of Lebanon of California, displays gold medal awarded to this company for its new Syl-mer-treated wool jersey fabric. Robert E Huhnke, textile and leather industry sales division, Dow Corning Corp, examines the award-winning fabric, finished with Dow Corning's silicone for fabrics, Syl-mer. The gold medal was awarded to the modern California jersey mill by the judges of the 1958 International Textile Exposition at the California State Fair. Only five of these gold medals were awarded out of 273 entries from 27 countries. Lebanon's winning entry was a 100 percent wool jersey, weighing 11-oz and treated with Syl-mer. The jersey comes in a range of ten colors and is particularly adaptable to women's coats and suits.

CAMPUS-STYLE RESEARCH CENTER announced by Diamond Alkali Company, Cleveland, Ohio, will be located on an attractively landscaped 800-acre site in Concord Township, O, just a few miles south of Company's Painesville Plant and present research facilities at Fairport.

Shown here are models of Central Research Buildings as visualized and designed by the architects, Giffels and Rossetti, Detroit, Michigan.

The multi-unit project, according to Raymond F Evans, Diamond's chairman and president, "marks an integral part of a long-range research and development expansion program by Diamond to meet the Company's anticipated future growth needs and to maintain its competitive position in the chemical industry.

Eight Finishing Plants Appointed Syl-mer Licenses

Eight major finishing plants have been licensed to apply Syl-mer, water, spot and stain-resistant silicone finish, on apparel fabrics.

The new apparel licenses are: Dyersburg Cotton Products, Inc, Dyersburg, Tenn; Talbot Mills, Inc, North Billerica, Mass; Wyandotte Worsted Co, Waterville, Me; Palisades Dyeing Corp, Peace Dale, RI; Kerr Bleaching & Finishing Works, Inc, Concord, NC; Federal Processing Co, New York; Modern Cloth Sponging Co, Inc, Philadelphia; and Lyman Printing & Finishing Co, Lyman, SC.

Under the licensing agreements, each finishing company is authorized to apply Syl-mer to fabrics finished in its plant, in accordance with the quality-control standards which have been established by Dow Corning Corp. Syl-mer hang tags are made available from Dow Corning to manufacturing customers of the finishing plants.

Lindly & Co Names New Southern Reps

Howard C Lindemann, president, Lindly & Co, Mineola, NY, manufacturers of electronic, photoelectric, electromagnetic, optical measurement, detection, inspection and control systems, has announced the appointment of Electro-Motion Corp, 217 West Moorehead Street, Charlotte, NC, as representatives for North and South Carolina and portions of Tennessee and Virginia.

Dow-Baker Agreement on Dowex Resins

The J T Baker Chemical Co has announced the consummation of an agreement with the Dow Chemical Co, which provides that all laboratory quantities up to 50 lbs of established Dowex ion-exchange resins will be sold by Baker through the leading laboratory supply houses which now distribute 'Baker Analyzed' Reagents and other laboratory chemicals. This will provide quick availability of Dowex resins because orders can be serviced rapidly from convenient local stocks.

Dowex ion-exchange resins are supplied as 'Baker Analyzed' Reagents, each with the actual lot analysis on the label. Besides the regular Dow description, the J T Baker label reports the actual total exchange capacity, moisture content and wet screen analysis. Shelf-size glass bottles with plastic caps are used for packaging.

ACC Purchases Control of Macromol Corp

Stockholders of Atlantic Chemical Corporation have approved the purchase of the controlling interest in the Macromol Corp, Matawan, NJ. Macromol is a basic producer of macro-molecular chemicals and polystyrene resin, using the Klein Process and also constructs under license polystyrene-producing units both here and abroad. Max Klein continues as president of Macromol.

Atlantic Chemical Corporation manufactures dyestuffs, pigments and organic intermediates at facilities in Nutley, NJ, and anthraquinone vat dyes at a wholly owned subsidiary, Peerless Color Co, Plainfield, NJ.

TRI Fall Seminar Schedule

The Fall 1958 Seminars of the Textile Research Institute, Princeton, NJ, commenced October 23 with TRI's J H Dusenbury discussing "Effects of Drawing on Mechanical Properties of Nylon 6."

The remaining schedule is as follows:

Nov 6—"Hydraulic Acidity in Glycosides"—K Sarkanen, Cellulose Research Inst, Syracuse, NY

Nov 20—"Theoretical Elastic Modulus of Nylon and Dacron"—W J Lyons, TRI

Dec 4—"Tear Strength of Cotton Fabrics"—E D D Stavrakas, Fabric Research Laboratories, Dedham, Mass

Dec 18—"Static Electrification of Filaments"—D J Montgomery, Michigan State Univ

Jan 8—"Damage of Resin-treated Cellulose Fabrics"—M D Hurwitz, Rohm & Haas Co

Jan 22—"Infra-red Spectra and Hydrogen Bonding in Native Celluloses"—C Y Liang and R H Marchessault, American Viscose Corp.

All Seminars are held Thursdays at the TRI Laboratories at 2:30 pm.

Advance notice of planned attendance should be made known to TRI's Ludwig Rebenfeld. The Seminars are completely informal and no written reports are prepared.

• NAMES IN THE NEWS •

Winnacker

Karl Winnacker, president of Farbwerke Hoechst AG, Frankfurt-Hoechst, West Germany, recently celebrated his 25th anniversary with the German chemical industry. For more than six years he has been the head of the Hoechst Corporation, one of the largest chemical corporations in the world. The successful development of Farbwerke Hoechst AG during these years is due in a great measure to his initiative.

The appointment of **Erwin G Walker** as sales manager of its Fibers Division has been announced by American Cyanamid Co.

Mr Walker, who assumes his post December 1, will supervise the operations of the division's four sales departments. He will report to **William L Lyall Jr**, now general sales manager, who on that date will become director of marketing. Mr Walker's office will be in the division's headquarters at 111 West 40th Street, New York.

Reporting to Mr Lyall, in addition to Mr Walker, will be **Charles W Rice Jr**, manager, advertising and promotion department, and **Robert J G Schofield**, manager of technical service.

Mr Walker, who poined Cyanamid in 1936, has been sales manager of the dyes department of the company's Organic Chemicals Division since 1954.

Gaston Gage, a Clemson textile professor and department head since 1952, has been named dean of the Clemson College School of Textiles. He had served as acting dean since Nov 1, 1957.

The American Management Association recently announced the election of **M M Gouger** as vice president at large and a member of its Executive Committee.

Mr Gouger, who is vice president and director of personnel relations of General Aniline & Film Corp, will also serve as a member of the board of directors of the Association.

Davis

Kaswell

Painter

White

S Jack Davis, The Chemstrand Corp, Decatur, Ala, was elected president of the Fiber Society at the Society's recent annual business meeting at the Queen Elizabeth Hotel, Montreal. The meeting was a part of a two-day technical program held by the Society.

Davis succeeds **Wayne A Sisson**, American Viscose Corp, Marcus Hook, Pa. Other officers elected were **Ernest R Kaswell**, Fabric Research Laboratories, Inc, Dedham, Mass, vice-president; **E V Painter**, Johnson and Johnson, Chicago, Ill, and **Howard J White Jr**, Textile Research Institute Princeton, NJ, to three-year terms on the governing council. Re-elected were **Julian S Jacobs**, Textile Research Institute, Princeton, NJ, secretary; and **Hugh M Brown**, research consultant, Clemson, SC, treasurer.

The Fiber Society is a nonprofit organization composed of chemists, physicists and technologists engaged in research in the fields of fibers, fiber products and fibrous materials.

C J Waitkus has joined E F Drew & Co, Inc, Boonton, N J, as group leader in lubricant research and development. Mr Waitkus was formerly group leader of fiber finish research for the Chemstrand Corp, having been associated with that company since its formation. In his position he will be responsible primarily for the development and marketing of materials suitable for use in fiber and yarn manufacturing and processing.

Hart

Ernest H Hart has been appointed to Ciba Co, Inc's Chemical Specialties Department, where he will concentrate on sales promotion efforts. His appointment became effective September 1st.

Mr Hart has served as a technical sales promotion and development representative for Fair Lawn Finishing Co since 1946.

Problems of communication within large companies were underscored by **Fred J Emmerich**, a director of Allied Chemical Corp, before a meeting of the Society of Chemical Industry held recently at the Royal York Hotel, Toronto. **General Edward Hull**, president of the Manufacturing Chemists' Association representing Canadian and American chemical companies, introduced Mr Emmerich.

At the meeting, Mr Emmerich, former president and chairman of the board of Allied Chemical, was awarded the Society's Chemical Industry Medal for 1958, the 25th annual medal presented by the Society. The occasion was a joint dinner of the American, British, and Canadian sections of the Society.

Mr Emmerich's subject was entitled "New Dimensions for Management."

Nopco Chemical Company has announced the election of **Robert F McClellan** as vice president. Mr McClellan has also been appointed general sales manager of the Industrial Division.

Formerly vice president of Nopco Chemical Canada Ltd, Mr McClellan has been associated with the firm for over 31 years.

The annual award of the Textile Section of the New York Board of Trade will be presented to **F E Grier**, president of Abney Mills, Greenwood, SC, by **Ralph J Bachenheimer**, Textile Section Chairman. The presentation will be made at a luncheon at The Waldorf-Astoria on November 13.

Sarracino

Richards

Ross

Mather

Jerry J Sarracino has been named plant superintendent of Metro-Atlantic, Inc, Centredale, RI, where he will be in charge of coordinating plant production and distribution. Mr Sarracino worked for two years with Rock Hill Printing & Finishing Co before joining Metro-Atlantic in 1953.

Henry J Papini, Metro-Atlantic's executive vice president, is taking a five-week tour of European countries to survey possible markets for new textile resins and water repellents.

Wilfred D Rochon has been named sales representative and technician for Organic Chemical Corp. He will cover the New England area from the main plant in East Providence, RI.

Mr Rochon was employed most recently by Collins & Aikman Corp as superintendent of dyeing and finishing.

Kaplan

Martin P Kaplan, a freshman at the Philadelphia Textile Institute, has been awarded the Jesse Seidenwurm four-year $2500 scholarship established by Burlington Men's Wear Fabrics Co, a member of Burlington Industries.

Kaplan has stated that his occupational goal is in the field of textile chemistry.

Thomas L Bonnitt has been appointed manager of market development at Morningstar-Paisley, Inc, New York. The newly created department will provide constant evaluation and development of the Company's line of starches, gums, dextrines, latex, etc, for the textile and other industries.

David J Richards has retired as vice president—sales and director of E F Houghton & Co, Philadelphia. Succeeding him as vice president—sales is **Frank Ross**, formerly assistant to the vice president—sales. **Charles R Schmitt** succeeds Mr Ross as assistant to the vice president.

Mr Richards served 41 years with Houghton. Starting as a salesman, he successively became Pittsburgh sales manager, Central Division sales manager, assistant director of sales and a member of the board of directors before assuming his most recent position in 1945.

Mr Ross, who has been with Houghton since 1942, was elected to the board of directors in 1957.

Mr Schmitt became national manager of the Lubrication Sales Dept in 1951, a position he will continue to hold in addition to his new responsibilities.

The National Cotton Council has added **Werner Pels** to the technical staff of its utilization research division.

Mr Pels will be located in the Council's Washington office.

PAUL E L BRUCK

PAUL E L BRUCK, salesman to Metropolitan New York's textile and latex industries for Stein Hall & Co, Inc, for the past five years died suddenly on October 9th following a heart attack. He was 57 years of age.

Mr Bruck had joined Stein Hall in 1953 as a latex and rubber salesman. He subsequently took a sales assignment in the company's New York Sales Branch Office and specialized in textile liquid specialties and latex accounts.

Before his going with Stein Hall, Mr Bruck had been connected with the Revertex Corporation and the Rubber Corporation of America.

MARVIN O SHRADER

MARVIN O SHRADER, 45, supervisor, organic chemicals research of Pittsburgh Coke & Chemical Company's Research & Development Department, passed away suddenly Sunday morning (September 21) in St Clair Memorial Hospital, Pittsburgh.

Dr Shrader had been awarded numerous U S and foreign patents in the field of industrial chemistry. He joined Pittsburgh Coke & Chemical Company in 1952, and had previously been associated with the General Aniline & Film Corporation.

Frank A Mather has been named a technical representative for Para-Chem, Inc, in the sale and application of latex compounds for the textile, paper and adhesive fields.

Mr Mather joins Para-Chem, Inc after two years as a special representative for the Chemical Division of Goodyear Tire and Rubber Company. In this capacity he had broad experience in the sale and service of latices, resins and chemicals. Prior to his association with Goodyear he had five years of technical service and sales experience with General Latex and Chemical Corp.

W W Seward has been elected vice president of General Latex and Chemical Corp (of Ga). Mr Seward, who retains his position as general manager, was named to his post at a recent meeting of the board of directors.

Welles

Ernest Welles, a member of the laboratory staff of Dexter Chemical Corp, New York, since 1952, has been named chief chemist of the company's Plant #1, where he will be in charge of quality control and development work on surface-active agents for the textile and paper industries.

Dexter also has announced the addition of **Marvin Eichenblatt** and **Fielding L Gentry** as chemists, and **Bryan Cropley** as a laboratory assistant. Eichenblatt, who was employed by Interchemical Corp prior to entrance in the army in 1956, received an award from AATCC for his outstanding work at Fairleigh Dickinson University as a student. Gentry and Cropley are also recent college graduates, Gentry having been elected to the National Honor Society in science.